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EMPIRE FORESTRY CONFERENCE.

AUSTRALIA AND NEW ZEALAND, 1928.

FORESTRY HANDBOOK

FOR

NEW SOUTH WALES.

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FORESTRY HANDBOOK

FOR

NEW SOUTH WALES.

Prepared by the Forestry Commission of New South Wales.

Issued under the authority of
The Hon. F. A. CHAFFEY, M.L.A., Minister for Forests.

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INTRODUCTORY.

Excluding the Federal Capital Territory, New South Wales embraces an area of 309,432 square miles—a little over one-tenth of the area of the continent.

Neglecting minor indentations, it has a coast line of 700 miles fronting the South Pacific Ocean. This is equivalent to 443 square miles of area to one mile of coast-line.

It lies almost wholly south of the 29th parallel of South latitude, and north of the 36th parallel of South latitude. Its western boundary is formed by the 141st meridian of East longitude, and it is almost wholly west of the 152nd meridian of East longitude.

The capital of New South Wales is Sydney, situated on Port Jackson, near the middle of the coast-line, with a population of 1,100,000. It is the chief port of New South Wales, and all the railways radiate therefrom.

The total population of the State is approximately 2,402,000, and the following table shows the chief towns with a population of 5,000 or over, in 1926, together with the principal industries of the surrounding districts.

Town.	Population.	Industries.
South Coast—		
Bulli	5,500	Coal-mining.
Wollongong ...	8,000	
Camden	5,400	Dairying and agriculture.
Parramatta ...	16,000	Dairying and agriculture, fruit growing and manufacturing.
North Coast—		
Gosford	11,000	Agriculture, fruit growing, dairying, and timber.
Newcastle... ...	122,000	Coal-mining, ironworks, manufacturing, dairying, agriculture, timber.
Cessnock	20,000	
West Maitland ...	11,300	
Grafton	6,300	Dairying, sugar, and banana cultivation, mixed farming, timber.
Casino	5,000	
Lismore	9,500	
Southern Highlands—		
Goulburn	15,000	Wool and agriculture.
Crookwell ...	5,000	
Central Highlands—		
Katoomba ...	12,000	Health resort.
Orange	16,000	Wool, mixed farming, fruit growing.
Lithgow	15,000	Coal and ironworks, cement.
Bathurst	14,000	Wool and agriculture.
Northern Highlands—		
Tamworth ...	10,000	Wool and agriculture.
Armidale	5,500	
Glen Innes ...	5,000	
Inverell	6,000	

Town.	Population.	Industries.
CENTRAL DIVISION—		
Albury	11,000	Wool and wheat mainly, and in places, fruit and timber.
Wagga Wagga ...	9,500	
Junee	5,000	
Cootamundra ...	7,500	
Narrandera ...	7,000	
Cowra	5,000	
Forbes	5,000	
Parkes	5,000	
Wellington ...	5,000	
Dubbo	6,500	
Murrumbidgee Irrigation Area	12,000	Intense farming and fruit culture; rice growing.
WESTERN DIVISION—		
Broken Hill ...	28,000	Silver-lead mining.

RAINFALL AND CLIMATE.

The State of New South Wales contains an area of approximately 198,000,000 acres, 15 per cent. of which, in the Western Division, receives a rainfall of less than 10 inches per annum, while, on an additional 43.5 per cent., the average annual precipitation is between 10 and 20 inches. On slightly over 2 per cent. of the State, embracing 4,328,000 acres, the rainfall exceeds 50 inches, while about 5 per cent. (10,000,000 acres) receives between 40 and 50 inches, and on 10 per cent. (20,000,000 acres), between 30 inches and 40 inches are recorded.

In view of the oft-repeated statements re the percentage of the total area of a country which should be devoted to forests, it is important to note that on 40 per cent. of the area of the State the rainfall is below 15 inches, snow unknown and temperatures very high in summer, so that forest growth is quite impossible—except under irrigation, while to this area must be added a very doubtful 18.5 per cent. between 15 inches and 20 inches, and over 24 per cent. on which, the precipitation being between 20-30 inches and the rate of evaporation high, first-class forest growth is not to be expected except on good retentive but well drained soils. This leaves slightly over 17 per cent., or 34,000,000 acres, on which the rainfall exceeds 30 inches, and in which, other conditions being satisfactory, dense forest growth might be possible, but which must, at the same time, be expected to provide much of the land to be devoted to close settlement.

As will be seen from the map accompanying the handbook, the variation in rainfall from below 10 inches upwards proceeds more or less regularly from the western plains of the interior towards the east coast, any irregularity in the isohyets being due mainly to the topography, though they are modified also by the varying monsoonal and antarctic influences.

A notable example of an abrupt irregularity is seen in the appearance of the 20-inch isohyet on the Monaro tableland in close proximity to the east coast, along which the rainfall is generally over 30 inches and not infrequently over 40 inches. The highest rainfall is recorded near Byron Bay, where it frequently exceeds 70 inches, while on comparatively small areas around Coff's Harbour and Port Macquarie, on the North Coast, and on the southern highlands it may exceed 60 inches.

More important, however, than average rainfall in its effect on forest vegetation, are the rate of evaporation, the frequency of droughts and the distribution of rain throughout the year, and though the variation of conditions in New South Wales is too great to allow a generalisation for the whole of the State, in a large part thereof these factors certainly react unfavourably upon the forestry possibilities.

Evaporation, being of course mainly dependent upon temperature and winds, is most rapid in the interior where the summer temperatures are high, often exceeding 110 degrees Fahrenheit in the shade, and where the prevailing westerly winds are frequently extremely dry. Moreover, by reason of the low winter rainfall and clear skies accompanied by frosty weather, the loss of soil mixture in the winter also is considerable. On the coast the temperatures are much lower, rarely exceeding 100 degrees Fahrenheit, while the north-easterly and south-easterly winds from the sea are moisture-laden so that evaporation is much less and the conditions for luxuriant tree growth of certain type more favourable, comparatively, than the difference in rainfall would indicate.

Figures showing the rate of evaporation from a free water surface have not been compiled for many stations in New South Wales, but a selection from the returns made available by the Commonwealth Meteorological Department is as follows:—

Station.	Average Rainfall. inches	Average Evaporation. inches
Wilcannia (far western)	10	63·5
Leeton (central)	17	53·
Sydney (moist coastal)	48	37·

The periodical recurrence of years of low rainfall not only has a marked effect on existing forest vegetation, but also is extremely important in that it practically prohibits at present the undertaking of expensive forest cultural operations. Drought killed natural forest—the condition certainly intensified by fire—is not uncommon in inland districts, especially where the soil conditions are unfavourable, with the result that in the western half of the State, where such occurrences are to be feared, the risk of loss is so great as to preclude heavy expenditure on forest operations being incurred. An indication of the variation in rainfall to be expected is given by the fact that, at one forest station where the average rainfall is 16 inches, the fall recorded was below 9 inches twice in the nine years from 1919 to 1927. In the eastern half of the State, death of well established forest from drought has been rarely, if ever, recorded, difficulty caused by years of low rainfall being experienced only in connection with the establishment of the new crop, whether by natural or artificial means.

As a result of the wide range in latitude covered by the forest area of the State, there is considerable variation in the distribution of rainfall throughout the year, but, generally speaking, the greater part of the State is outside the winter rainfall belt. Examination of the average rainfall figures supplied by the Commonwealth Meteorologist shows that the districts in which the three months of highest average rainfall fall between May and September are confined to the south-western slopes and the Riverina lying between the Murray and the Murrumbidgee. Even in the southern tablelands some of the stations show maxima in the summer months of December and January rather than in the winter.

The far North Coast is definitely a region in which the average rainfall is greatest in the months of January, February and March, while in the remainder of the northern half of the State the summer and autumn months receive more rain than the winter and spring. Elsewhere, as in the central tablelands, the central western slopes and plains and the South Coast, the maxima are distributed irregularly throughout the year, with the tendency in all parts for the maxima to occur less frequently in the spring. This uncertain and irregular distribution of rainfall is of considerable importance to that part of sylvicultural practice which deals with the establishment of young forests artificially, particularly in the northern half of the State where the winter sun is frequently warm. Generally it may be stated that, except for parts of the southern and central tablelands and the south-west slopes, the State possesses an uncertain planting climate which adds considerably to the difficulties and expense of afforestation. On the other hand, the fact that the rainfall in the north-eastern zone is distributed throughout the year, even though irregularly, assures the prolific natural regeneration of eucalypts.

The Frost Map of Australia published by the Commonwealth Meteorological Department shows that the greater part of the Central Division is subject to frosts during the seven months April to October, while in the narrow low-lying coastal fringe the frost period covers the months June to August. On the northern, central and southern tablelands, however, frosts are of much greater severity and occur generally from March to November, while in a very limited zone, within a narrow radius from Kosciusko, frosts may be experienced during any month of the year. Although forests species in any one locality suffer from frosts of a severity exceptional thereto, it is only in the southern highlands that forestry operations are seriously inconvenienced. Winter frost-lifting in nurseries, of course, occurs frequently at the higher altitudes, but this is of little importance compared with the occurrence in the middle of the growing season of severe frosts which limit coniferous planting at 4,500 feet to specially hardy species such as *P. ponderosa, contorta, and laricio.* Above this altitude no experience has yet been gained.

Snow fall, though experienced along the whole length of the highlands, is heavy only in the south at elevations above 3,500 feet, where much damage is caused by snow-break to the crowns of eucalypts, the genus being susceptible to this form of damage.

SUMMARY OF THE GEOLOGY OF NEW SOUTH WALES.

By S. M. TOUT, Secretary Forestry Commission.

The boundaries of the States into which the continent of Australia is divided for political purposes are mainly artificial. Consequently the geological features of any one State are frequently co-extensive with those of adjoining States. The continent embraces three extensive physiographical regions: (*a*) a plateau of from 1,000-1,500 feet above sea level, embracing practically the whole of Western Australia and the Northern Territory, and the western portions of Queensland and South Australia; (*b*) immediately to the east of this plateau a belt of relatively low-lying, more or less level-bedded deposits extending across the continent from south to north; and (*c*) on the extreme east a cordillera along the Pacific coast. The State of New South Wales embraces portions of the two last-mentioned regions.

In New South Wales the cordillera comprises a series of plateaus running in a north and south direction close to the coast. On the south these plateaus are a continuation of similar highlands in Victoria and in the north are continuous with the south-eastern Queensland plateau.

The eastern margin of this tableland belt has been much dissected by erosion, which, together with faulting, &c., has given rise to a relatively low-lying area along the greater part of the coast, which will be referred to as the coastal area. The average width of this coastal area is about 30 miles; in the valley of the Hunter River its width is about 150 miles; and at places the highandls abut on the coast. The tablelands have a comparatively abrupt fall to the coastal region, but slope gently to the west, passing into region (*b*) above-mentioned. The part of region (*b*) in New South Wales is usually referred to as the Western Plains.

Brief Description of the Coastal Belt.

In New South Wales the direction of the main folds and faults is not sufficiently parallel to the trend of the coast line as to warrant the coast being described as of the Pacific type, neither is there such an absence of parallelism as in the Atlantic type; it has been described as a "sub-Pacific" type of coast The coast has an extremely uniform trend in a south-south-west to north-north-east direction.

The River Murray forms the greater part of the boundary between the States of Victoria and New South Wales. From the head of this river south-easterly the boundary consists of a line drawn to Cape Howe. The upper ordovician strata of Victoria extend into New South Wales across this line. These strata consist of carbonaceous shales, claystones, sandstones, and schists. The shales are graptolite bearing. With extensive intrusions of granites and with the addition of Silurian and Devonian sediments, these rocks extend along the coastal belt to a little north of Bateman's Bay. The highlands are near the shore throughout this section of the coast, and spurs thereof reach to the shore. Consequently the coastal belt here is narrow and the rivers short.

North from Bateman's Bay is the southern rim of a geosyncline of Permo-Carboniferous sediments. These sediments form a great basin with its centre practically beneath Sydney, and contain coal deposits which are mined in various places to the south, west, and north of Sydney. In New South Wales there is no typical Permian formation similar to that of Europe, but the fauna of these sediments overlying true Carboniferous strata partakes of the nature both of the Carboniferous and Permian fauna of the Northern Hemisphere, hence the name "Permo-Carboniferous." Throughout the greater part of the geosyncline above-mentioned, these Permo-Carboniferous strata are overlain by Triassic sediments.

The Permo-Carboniferous strata comprise both marine and fresh water sediments, consisting of sandstones and shales with basalt flows and tuffs in places. The fossil flora includes *Glossopteris, Gangamopteris,* and *Dadoxylon*—and the fauna *Fenestella, Stenopora, Dielasma, Productus, Martiniopsis, Spirifer, Mœonia, Edmondia, Eurydesma, Keenia, Platyschisma, Goniatites,* &c.

In this section of the coast north of Bateman's Bay, these sediments have but a gentle dip and are alternately hard and soft strata. They thus give rise to the development of vertical cliffs on the seaboard. The headlands giving rise to Jervis Bay (the port of the Federal Territory) result from the local occurrence of a relatively resistant rock, "the Nowra Grit." At Kiama, a little to the north, basalt flows occur. Some are columnar and are extensively quarried for road and concrete-making. At Clifton, on the coast, one leaves the rim of the Permo-Carboniferous geosyncline and enters on the over-lying Triassic sediments. These Triassic strata outcrop along the coast as far as Lake Macquarie to the north of Sydney, and consist mainly of freshwater sandstones and shales, characteristic fossil plants being *Thinnfeldia* and *Macrotæniopteris*. The lowest strata, 1,700 feet thick, are known as the Narrabeen shales; next above these are the Hawkesbury sandstones, 1,000 feet thick, and at places the topmost Wianamatta shales, but these latter have disappeared from much of the area through erosion. The section of the coastal belt occupied by these Triassic rocks has, in late geological time, been subjected to successive uplift and erosion, and finally to a general subsidence. This subsidence resulted in the "drowning" of the trunks of the then existing coastal rivers, giving rise to magnificent many-bayed harbours such as that on which Sydney is situated (Port Jackson) and Broken Bay. The hard Hawesbury sandstones overlying the softer Narrabeen shales yield a coast-line consisting of sandstone cliffs with intervening stretches of sandy beaches.

About Lake Macquarie is the northern inner rim of the geosyncline of Permo-Carboniferous rocks, the southern rim of which has been described as occurring to the north of Bateman's Bay. Hereabouts occurs the widest section of the coastal belt. The Hunter River eroding the relatively soft Permo-Carboniferous rocks has carved out its valley much more rapidly than coastal rivers to the north and south have been able to in the harder rock formations of their valleys. This, coupled with the capture of north and south flowing rivers of an earlier geological system, has enabled it to cut well back into the highlands, so much so as to almost break through into the western plains near the town of Cassilis. For the same reasons the Hunter River has attained a relatively more mature stage of development than other coastal rivers. It is in this portion of the coastal belt that the coal deposits of the Permo-Carboniferous series are most extensively mined. The northern rim of the geosyncline continues along the coast as far north as Port Stephens.

From Port Stephens to a little south of Camden Haven Carboniferous strata outcrop in the coastal belt. These Carboniferous rocks run in a north-westerly direction from the coast practically through the highland region. They comprise a lower series of marine mudstones and tuffs, limestone and conglomerate—the fauna of which is rich in brachiopods of

Genera *Orthis, Productus, Spirifer, Dielasma*—the chief fossil plant is *Lepidodendron veltheimianum.* The upper strata consist of glacial tills, tuffs and rhyolite; characteristic fossils are *Rhacopteris* (*aneimites*) *sp.* A little to the north of these Carboniferous beds—commencing at Port Macquarie—occurs a belt of serpentine, which runs approximately parallel to the Carboniferous rocks and outcrops at intervals in a north-westerly direction almost across the highlands. The date of its intrusion is placed as late Carboniferous. From Camden Haven to Trial Bay Permo-Carboniferous (Lower Marine) sandstones outcrop. From Port Stephens to Trial Bay the rocks occurring on the coast are tilted and folded, are mostly hard and free from excessive jointing, so that they have been more resistant than the remainder of the coast of New South Wales, the shore in this section forming a pronounced bugle eastwards. From Trial Bay to a little north of Coff's Harbour (Woolgoolga) Silurian rocks again outcrop on the coast. Here also the tableland is close to the shore.

From Woolgoolga to Byron Bay the coastal belt again embraces Triassic rocks, known as the Clarence Series (after the Clarence River), comprising freshwater shales, sandstones and conglomerates—the fossil flora of this series is different to that of the Triassic rocks occurring in the coastal belt near Sydney. The Clarence Series has a flora similar to Triassic beds occurring at Ipswich, in Queensland—*Taeniopertis Daintreei* and *sp.* of *Thinnfeldia.* These strata are more or less horizontally inclined and on the seaboard present sandstone cliffs.

From Byron Bay to the Queensland border (embracing the valley of the Tweed River) the coastal belt is formed of highly folded slates believed to be of Ordovician Age.

Brief Description of the Tableland Region.

The series of plateaus forming the Cordillera in New South Wales fall naturally into three groups. The Southern or "Monaro" tableland extends from the Victorian border to what is called the Lake George geocol, just south of the town of Goulburn. North of this geocol what is known as the "Central" tableland extends to the Cassilis geocol at the head of the Hunter River. North of this gap the "New England" tableland extends to the Queensland border.

The Monaro Tableland.

This embraces what was evidently originally a single peneplain, but which now, as a result of uplift accompanied by extensive faulting, comprises a series of fault blocks. These blocks are of varying heights—lowest on the east towards the coast (1,000-2,000 feet above sea level)—highest in the vicinity of Kosciusko (average 6,000-6,500 feet), Mount Kosciusko, 7,306 feet, being the highest point in Australia. The general trend of the faults and of the fault blocks constituting this tableland area is north and south. The fault escarpments have, of course, been much denuded, but still stand sufficiently above the surface of the adjacent blocks as to be named as mountain ranges.

Some of the fault blocks lie so much below the adjacent blocks on either side as to constitute rift valleys or senkungsfelder. Notable amongst these rift valleys is the "Colinton Senkungsfeld," along which the Murrumbidgee River flows northerly and along which has been constructed the railway line from Queanbeyan to Cooma, southerly from Canberra. The upper western branch of the Snowy River also occupies another of these rift valleys.

The topograph of one of the smallest of the fault blocks in the Southern Highlands—the Kosciusko tableland—has been modified by glaciation. This is the only place on the mainland where such evidences of glaciation as U-shaped and hanging valleys, glacial lakes, striated rocks, lateral and terminal moraines are to be found.

The greater part of the Monaro Tableland is occupied by Pre-Cambrian and Lower *Palaeozoic* rocks. East of the glaciated Kosciusko Tableland there is a belt of Upper Ordovician graptolite-bearing strata. There are also extensive outcrops of metamorphic rocks such as gneisses, schists and phyllites of possibly pre-Cambrian age in the vicinity of Cooma and towards Albury, and extensive intrusions of granitic rocks of pre-Devonian Age elsewhere throughout the Monaro tableland. Towards its northern edge this tableland embraces chiefly Silurian shales, sandstones, conglomerates and limestones. Near Gundagai there is an outcrop of serpentine forming a belt running in a meridional direction.

The Central Tableland.

This tableland is also in reality a group of tablelands of different altitudes resulting from the unequal uplift of a previous peneplain. The Blue Mountain Tableland west from Sydney ranges from 700 to 4,000 feet in height; its eastern margin is a steep monoclinal fold. West of this tableland occurs a senkungsfeld in which the town of Bathurst is situated and west of this again the Orange-Blayney tableland of an average height of 3,000 feet. Much of the Blue Mountain tableland consists of the Triassic sandstones occurring about Sydney in the coastal belt, but towards its south-western margin (Jenolan Caves) Silurian limestones, claystones and slates and radiolarian cherts occur with intrusions of granitic rocks. Similar strata of the same geological age occur in the Bathurst senkungsfeld and in the Orange-Blayney tableland. Some of the residual peaks in the Blue Mountain tableland are basalt capped, and near Orange (Canoblas Mts.) a Tertiary volcanic cone of alkaline lava occurs.

Towards its southern margin the Central tableland embraces mostly Silurian and Devonian sediments with intrusions of granite. The Silurian strata consist of shales, limestones, sandstones and quartzites. The limestones are rich in fossil corals (*Heliolites*, *Favosites*, *Cyathophyllum*, *Halysites*) Brachipods (*Pentamerus* and *Spirifer*) and Trilobites (*Phacops* and *Encrinurus*). The Devonian strata consist of shales, limestones and rhyolite lavas and tuffs, the limestones containing fossil corals such as *Diphyphyllum*, *Cyathophyllum*, etc., and brachiopoda such as *Spirifer* and *Rhynchonella*.

In the Mittagong-Bowral districts there are cones of alkaline igneous rocks (Bostonite and trachyte). The western margin of the coal-bearing Permo-Carboniferous geosyncline described under the coastal belt also outcrops in the Central tableland area, the coal seams thereof being mined at Lithgow.

The New England Tableland.

This also is a complex series of plateaux of different heights, the result probably, in part, of block faulting, but mainly of differential erosion during various cycles of erosion accompanying repeated uplift. The lower plateau levels are composed of crumpled *Palaeozoic* sediments and basic plutonic rocks.—the higher broad residuals are composed of siliceous granites or rhyolites—these siliceous granites having intruded the basic rocks of the lower levels. The higher residuals in the northern parts of the tableland range up to 5,300 feet in height.

In describing the coastal belt above, reference was made to an outcrop of Carboniferous rocks running from the coast north of Port Stephens northwesterly across this tableland, and to a belt of serpentine more or less parallel to these carboniferous rocks. On the north-eastern side of these carboniferous rocks Lower Devonian strata occur extensively. These comprise coralline and radiolarian limestones, claystones, tuffs and cherts with spilite lavas—the latter are particularly conspicuous near Nundle. Fossil corals of species of *Diphyphyllum, Syringopora, Favosites, Sanidophyllum, Spongophyllum, Actinocystis* and *Heliolites* are common in the limestones—and the characteristic fossil of the claystones is the lycopod *Lepidodendron australe*.

To the south-west of the carboniferous rocks permo-carboniferous coal-bearing strata occur—coal being mined in the vicinity of Gunnedah.

Further west are the Warrumbungle Mountains, and to the north of these the Nandewar Mountains, groups of extinct volcanic cones of alkaline lavas and tuffs reaching to 5,000 feet. These are similar to the alkaline rocks of the Canoblas Mountains near Orange, in the Central highlands.

North-east of the serpentine belt the rocks are mostly granites and basalts, and towards the eastern falls of the tableland Silurian strata (slates, etc.) occur. The plateau in the middle east of these highlands, known as the Dorrigo Plateau, is mainly basalt capped.

The eastern margin of the tablelands constitutes the main water parting of the State, giving rise to two systems of rivers, one flowing to the east, including mostly short rivers entering the Pacific; the other including relatively long slowly flowing rivers flowing into the Darling and Murray Rivers—the last-mentioned entering the Southern Ocean in South Australia. This water-parting is usually shown on maps as the "Great Dividing Range"; this range does not always embrace the highest portions of the tablelands. Generally the falls from the tablelands to the coastal belt are abrupt, while the slope westerly is much more gradual. The uplift giving the cordillera its present elevation is believed to have taken place in Tertiary times. There has been much river "piracy" in geologically recent times, especially in the case of the coastal rivers which have "captured" the older north and south flowing rivers of an earlier system. A glance at the direction of the head-waters of some of the western system of rivers will show that this piracy is not confined to the coastal system.

The upper courses of both the eastern and western systems of rivers are more or less "juvenile," particularly so in the case of those of the coastal watershed, many of which in the north emerge from the tableland over waterfalls.

The "Western Plains."

As stated above, this is the name by which the part of the mid-Australian low-lying belt embraced in New South Wales is generally known.

The central and southern portions of the western plains form part of what are known as the "Murray-Darling Lowlands," which extend into Victoria and South Australia, but, for the greater part, lie in New South Wales. The Murray-Darling Lowlands, named from the two chief western rivers which traverse them, lie below 2,000 feet above sea level, and comprise three separate formations. An eastern strip flanking the Monaro and Central Tabelands, and stretching from the Murray River, near Albury, almost to the Darling River, near Bourke and Louth, is known as the "Cobar-Wagga Peneplain," after the most important towns near its northern and southern extremities. Like the highlands adjoining it on the east, this peneplain is composed mainly of Silurian and Devonian strata with numerous granite intrusions, but unlike those highlands it has not participated to any great extent in the uplift which raised them to their present height during Tertiary times. The second and largest component of the Murray-Darling Lowlands lies to the west of the Cobar-Wagga Peneplain, and constitutes the flood plains of the Darling, Lachlan, Murrumbidgee, and Murray Rivers. These plains are extremely flat for a land surface, having an average slope of but 18 inches per mile from the bed of the Darling easterly to the Highlands. Neither rocky outcrops nor hills occur for hundreds of miles in this second section of the Murray-Darling Lowlands, which are believed to represent the uplifted bed of a former inland sea. These plains consist of deep red and black soils containing much sodium chloride and gypsum. The southern part of these plains between the Lachlan, Murrumbidgee, and Murray Rivers is about 200 miles wide east and west, and is known as the "Riverina."

In the south-western portion of the State is the third and smallest section of the Murray-Darling Lowlands; this portion probably represents the uplifted bed of a Pleiocene arm of the southern ocean into which the Darling Murrumbidgee, and Murray rivers flowed by seperate mouths. The rocks outcropping in this formation (which occurs more extensively in the States of Victoria and South Australia adjoining) consist of Tertiary marine sediments.

To the north-east of the Cobar-Wagga Peneplain, along the course of the Bogan River, and between that river and the Macquarie River, there occurs another relatively narrow strip of plain of post-Tertiary deposits. To the north of the Murray-Darling Lowlands the western plains of New South Wales (and of Queensland adjoining) embrace part of a great artesian basin. The lower strata of this basin in New South Wales comprise porous Cretaceous and Triassic sandstones. These are overlain by impermeable strata. These strata are upturned at their eastern outcrop, and further west contain valuable supplies of artesian water. Geologists are divided in opinion as to whether these supplies of artesian water are derived from rain falling on the upturned margins of these porous strata, or have been given off during the cooling of deep-seated igneous rocks.

West of the Murray-Darling Lowlands and these artesian sediments in New South Wales, near Broken Hill, and north of that town, there occurs an extension of the South Australian Cambrian and pre-Cambrian highlands. These formations contain the world-famous silver-lead-zinc deposits of Broken Hill. The pre-Cambrian series consist mainly of metamorphic rocks, gneisses, schists, amphibolites, and phyllites. The Cambrian strata comprise slates, quartzites, limestones, and glacial tills.

Note.—In compiling the foregoing summary the writings of Professors Sir Edgeworth David, T. Griffith Taylor, and W. G. Woolnough, and of Messrs. C. A. Süssmilch and E. C. Andrews have been freely used.—S.M.T.)

FORESTRY IN NEW SOUTH WALES.

By N. W. JOLLY, B.A., B.Sc., Forestry Commissioner of New South Wales.

DISTRIBUTION OF THE FORESTS.

The geographical situation of the State, the topography and the wide range of climatic conditions experienced, all combine to make New South Wales perhaps the most interesting part of Australia from the standpoint of forestry. Its coastline extends for about 700 miles from the Queensland to the Victorian border, and, at its northern extremity, a high rainfall combined with rich volcanic soil gave rise to what was formerly one of the most luxuriant belts of rain forest on the continent, yielding large quantities of the famous Red Cedar, perhaps the most valuable cabinet timber in the southern hemisphere. In the south, in close proximity to the Victorian border, where its mountains rise to an altitude of over 7,000 feet, snow may be seen lying in midsummer and no forests exist, while in between and to the west the climate ranges from mild and equable to intensely arid. Notwithstanding this great variation, the dominant note throughout the forest vegetation of the State, except in the dry west, is the genus Eucalyptus which, unfortunately perhaps for the development of forestry, was far too abundant for the original needs of a small community and comprised too many species not possessing special value. West Australia may excel in the size and yield of the huge Karri and in the possession of large areas of comparatively pure forests of Jarrah, while Victoria and Tasmania can point with pride to the giant Regnans, but New South Wales with its long coast line in the centre of the Eucalyptus zone, once possessed by far the largest area of good hardwood forest and an extremely interesting range of species.

Coastal Hardwood Forests.

Prime forest was not continuous throughout the whole of the coastal zone, for the variation in soil and topography causes rapid changes in the quality of the stand, even in the best localities, but, except for a break caused by the barren Hawkesbury sandstone north, south and west of Sydney, and for a marked falling off of the growth in the dry Hunter River basin, fair to good forests extended from the Victorian border to the "Big Scrub" or jungle south of the Tweed River on the Queensland border. Though a considerable proportion of this forest area still remains, the fact that much of it at present is of minor importance in the economy of the State is due largely to the ravages of fire and the axe, and also to the scarcity of a timber-using population capable of utilising its frequently low grade produce and developing it intensively.

The width of the good forest belt in this humid coastal zone is generally not great, and may be as narrow in some places as 10 miles, while occasionally in the north it is as much as 50 miles, including, of course, the lower grade areas and patches of rain forest which always intervene. In certain places, to be mentioned later, stands are found in which one species predominates, but generally the forests are mixed, while it is a peculiarity of most of the species that, when old, they are very subject to heart rot, white ants and faults of various kinds, so that a high yield per acre of first-class timber of one species is never obtainable. It is for this reason largely that New South Wales has not been able to develop large sawmills and an export trade comparable with that of Jarrah from West Australia, notwithstanding the fact that considerable areas of forest are readily accessible by the coastal rivers. The continued growth of the State and the exhausted condition of the most accessible forests will now prevent any big advance being made in this direction in the future.

Between the southernmost end of the coast and the north there is an almost complete change of the species composing the main crop, the change northwards being generally for the better as far as durability and value of timber are concerned. Reference will be made here only to the most important of the numerous species, and in this connection it is emphasized that the botanical nomenclature of some eucalypts has long been the subject of dispute, so much so that, for lack of knowledge of just what types some species embrace, foresters are unable, in some cases, to speak definitely *re* their ranges. This applies particularly to the Stringybarks of the *eugenioides* types and to the narrow-leaved Messmates of Peppermints of the *radiata* type.

In the southern end the chief species are Coast Ash (*Euc. sieberiana*), which is seldom utilised, and the Stringybarks, comprising what are considered to be *Euc. muelleriana*, *capitellata* and a type of *eugenioides*, all of which are used for poles, and, to a certain extent, for sleepers. *Euc. sieberiana* is noteworthy for its capacity to grow on poor, sandy soils or on hard quartz ridges, and is unique in that it is the only coastal species of Eucalyptus in New South Wales whose timber may be split on the quarter. Two gums—*Euc. goniocalyx* and *Maideni*—occur also, but the most valuable and durable species in the south is the comparatively rare Box (*Euc. bosistoana*). A few miles north of Twofold Bay the commonest milling tree of the coast—*Euc. pilularis*, Blackbutt—makes its appearance, and continues at intervals northwards into Queensland. In southern localities it is frequently found on light, sandy country, where its development is much inferior to that met with on the stiffer soils of the north.

The most important of the South Coast species, Spotted Gum (*Euc. maculata*), appears near Bega, whence it also extends into Queensland. This species occurs either mixed with those already mentioned, or in pure forest, frequently affecting the ridges on soils of schistose formation, but occurring also on sands and on shallow clay subsoil. Its most extensive belts are found in the neighbourhood of the Clyde River, and, generally it, with a smaller percentage of *pilularis*, has been the main support of the sawmilling industry of the south coast. The timber is speciallly sought after for coachbuilding and is a valuable hardwood for all purposes, except where durability in the ground is required. Its sapwood is, however, readily attacked by the Powder Post borer, rendering it necessary to saw timber free of sap, with the result that only large-sized logs are saleable for ordinary milling purposes, though for handles—for which it is specially suited—smaller trees are acceptable. As a result in earlier days of failure to regulate the numbers and capacity of sawmills according to the extent of forest available, the greater proportion of the Spotted Gum forests have been heavily over-cut and continuity can be maintained only by the utilisation of those smaller trees which the market will not yet absorb.

Other species of value peculiar to the southern half of the coastal belt are Woollybutt (*Euc. longifolia*), a durable sleeper and pole timber, and Bangalay (*Euc. botryoides*), an ordinary milling hardwood; while northwards from the Clyde River such typically northern species as *E. paniculata*, *grandis*, *propinqua*, *corymbosa*, and *Syncarpia laurifolia* begin to take the place of the Stringybarks and Gums of the most southern localities, *corymbosa* in particular taking possession of the poor siliceous or ill-drained soils.

Coastal type Blackbutt, *E. pilularis.*

The coastal lands north of the Hawkesbury River to the Queensland border contain the finest forests and most valuable species: comprising *Euc. siderophloia* and *Euc. paniculata*, the red and grey Ironbarks which are in keen demand for poles, piles, sleepers, and girders both for home consumption and export: *Euc. propinqua*, Grey Gum, and *Euc. acmenioides*, White Mahogany, both first quality pole and sleeper timbers; *Euc. resinifera*, Red

Mahogany, *pilularis*, Blackbutt, *maculata*, Spotted Gum, *saligna*, Blue Gum, and *grandis*, Flooded Gum, all milling species of which *pilularis* is by far the most abundant; *Tristania conferta*, Brush Box, the premier timber for the decking of bridges and wharves; *Syncarpia laurifolia*, Turpentine, in constant demand for marine piles; and *Euc. microcorys*, Tallow-wood, undoubtedly the best all round hardwood in eastern Australia, in constant demand for all purposes, particularly poles, sleepers, and high-grading flooring. Next in abundance to pilularis is the widespread *Euc. corymbosa*, Red Bloodwood, a most durable pole and fencing timber, which, however, owing to its tendency to concentric gum veins, is rarely used for hewn or sawn purposes. *Euc. eugenioides*, White Stringybark, occurs on the North Coast in its normal form, but is less valued for durability than the southern stringybarks.

None of the northern species can be said to attain first-class development on poor dry soils, and moist well-drained loams are preferred by all, but there are wide differences between them in their ability to adapt themselves to poor soils. Under natural conditions the most exacting are *Tristania Syncarpia*, *Euc. pilularis*, *microcorys*, *grandis*, *saligna*, *paniculata* and *resinifera*; the less exacting include *Euc. eugenioides*, *maculata*, *propinqua* and *siderophloia*, while the least exacting of all are *E. acmenioides* and *corymbosa*.

The annual rainfall—fairly well distributed throughout the year—under which these coastal species grow ranges from 30 to 60 inches, and generally the finest growth occurs where an average of 50 inches and more is recorded annually. In the upper reaches of the Hunter River, where the precipitation falls nearly to 20 inches, is to be seen an interesting intrusion into the coastal zone of the typically inland species, *Euc. crebra*, with its associated confier, *Callitris*, while a similar intrusion of the same Eucalypt occurs to the west of Sydney. Another interesting fact is that, though apparently *Euc. microcorys* is essentially a sub-tropical species and one of the most exacting, yet it ascends to higher elevations than its associates, and is found at altitudes of 3,000 feet on the eastern slopes of the northern tableland where light snowfall may be experienced.

Brush Forests.

Interspersed amongst the coastal Eucalypt forests, in patches of greater or less extent, are the so-called " Brushes "—as the rain forests are commonly named in New South Wales. Throughout the greater part of this zone the Brushes occur chiefly in small patches along the gullies and water courses, where they serve as more or less effective firebreaks to the occur under a rainfall exceeding 50 inches, they were formerly of much Eucalypts; but, where comparatively extensive areas of rich volcanic soil greater extent. Notable Brushes were those on the Illawarra, 50 miles south of Sydney, the Big Scrub between the Tweed and Richmond Rivers, and the Dorrigo plateau west of Coff's Harbour, which were the happy hunting grounds of the early Cedar-getters and have since rightly given way to settlement. Apart from the Red Cedar other valuable species such as Rosewood (*Dysoxylon fraseranum*), Yellow wood (*Flindersia oxleyana*), Teak (*Flindersia australis*), and White Beech (*Gmelina Leichhardtii*) occurred in varying quantity; but the most abundant of the large timber trees were the Black Bean (*Castanospermum*) and the Crow's Foot Elm (*Tarrietia argyrodendron*), which fell to the axe and fire before their value was appreciated. These old-time Cedar brushes will never be seen again.

Of a different class are the typical Hoop Pine brushes which, growing generally on less fertile soil than that of the Red Cedar brushes, produced a forest of miscellaneous species of smaller dimensions, over-topped by a scattered overwood of Hoop Pine (*Araucaria Cunninghamii*). Except in the gullies, the Brush species are generally of little present or propective value, though on the coastal highlands of the Dorrigo under a higher rainfall, an exception occurs, in that one species, Coachwood (*Ceratopetalum apetalum*) sometimes almost monopolises the stand, and produces forests which have considerable utilisation possibilities. Hoop is a noble tree with a fine cylindrical barrel occasionally showing 80 feet of clean stem, and not uncommonly containing 500 cubic feet of timber. Ordinarily, however, 100 cubic feet would be a reasonable average for the volume of single trees in typical Hoop Pine brush. For many years the utilisation of these forests has been directed almost entirely to Hoop, but quite recently the growth of the motor-body building industry has created a demand for Coachwood, which is easily seasoned and holds screws exceptionally well, so that there are now better prospects of obtaining closer utilisation.

Brush Type.

Hoop Pine (*Araucaria Cunninghamii*) and Miscellaneous Brush.

In the meantime, the concentration of operations on Hoop Pine, and the fact that considerable areas were alienated in the interests of the dairying industry, which always seeks the coastal brush lands, have so reduced the available supplies that it is only a question of a few years when there will be a definite shortage of this valuable softwood, the regeneration of which is economically difficult.

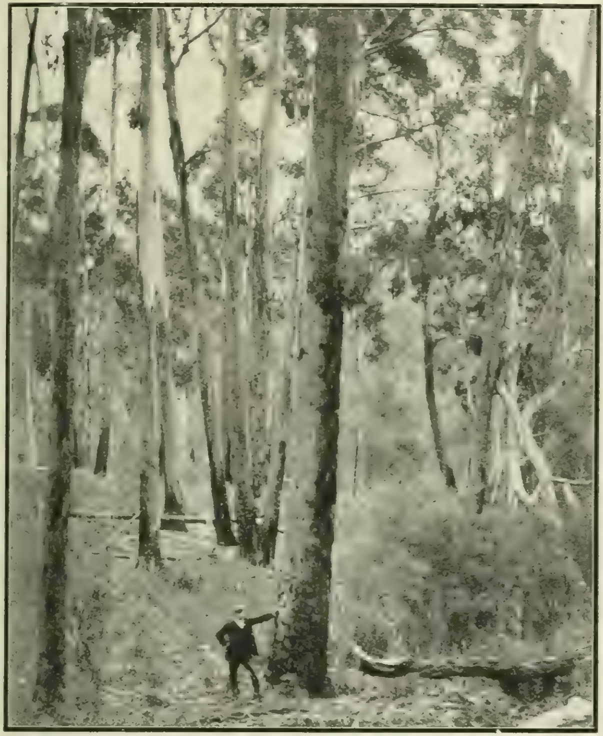
Highland Forests.

The hardwood forests of the highlands, which run approximately parallel with the coast, are very variable both in character and species, and are for the greater part much inferior to those of the coast in both the value of the timber and the quality of the forest. The best stands are located only in regions of comparatively high rainfall, generally exceeding 40 inches, and even these decrease in quality markedly with the change from loose, deep, to light or shallow soils, so that lower grade are much more common than high grade forests. Also as the rainfall decreases rapidly from East to West and the soils change in character very quickly, the first class forests are mostly very narrow, sometimes not exceeding one mile in width. With few exceptions the timbers are of the less heavy, non-durable types, and, consequently, are not greatly in demand amongst the comparatively scanty population, which looks upon the forest merely as a hindrance to the growth of grass.

Whereas the coastal forests are frequently stocked with an underwood of miscellaneous xerophytic species, a grass-covered floor is more frequently to be seen in the highland forests, though a dense brushy underwood and tree ferns are not uncommon on the high eastern slopes within the mist belt.

The most southerly portion of the highlands towards the Victorian border is divided into two zones by the bleak, dry Monaro tableland, which is composed largely of black basaltic soil, and, with its rainfall of about 20 inches, is either treeless or carries a very stunted growth of eucalypts, amongst which Snow Gum (*Euc. coriacea*) figures largely. The altitude of this tableland ranges from 2,000 to 3,500 feet, the elevation increasing both to the east and to the west. The higher ranges to the east fall within the maritime influence, and, being frequently enveloped in mist, carry a luxuriant vegetation wherever the soil conditions are favourable. The Eucalypts which give character to the forests of these ranges are *Euc. obliqua, fastigata* and *viminalis*, though *E. goniocalyx* and a form of *E. eugenioides*, with numerous others, are to be found at elevations up to 3,000 feet. On the stony shallower soils towards the Monaro a valuable phellandrene oil-yielding species, *E. dives*—Peppermint or Messmate—occurs either in scattered distribution in mixed forest, or comparatively pure, while *E. rubida* also is common on the poorer sites.

West of the Monaro greater altitudes are attained in the Australian Alps, where the rainfall increases to 60 inches, and though in the mountains south of Canberra *E. fastigata* is found, in the western ranges it and *obliqua* are generally replaced by the most valuable of all the non-durable mountain Eucalypts (*E. gigantea* or *delegatensis*), Mountain Ash. The distribution of this species is unfortunately limited and very patchy, due not only to its exacting requirements, but also to its extreme sensitiveness to fire and its inability to coppice. Altitudes between 3,500 and 4,500 feet, subject to snowfall of several feet per year, red soils of granitic or volcanic origin, and rainfall of 50 inches and more per year appear to be necessary to its best development. The country in which the *gigantea* forests occur is almost uninhabited in winter, its main present value being as summer relief country in drought time for sheep from western districts, a fact which accounts for the extent to which the forests have been burned in past years. The timber, though non-durable, is light and strong, and besides being suitable for cabinet work, panelling and high-grade flooring, has special uses for handles and boat oars. Its economic value is depreciated, however, by its tendency to gum veins and the consequent low percentage of clear timber, since only selected grades are able to command special prices, the rest finding as yet but a limited local market for house-building and, to a small extent, for fruit cases.



Southern Highlands Type.
E. gigantea or delegatensis.

Other species in the southern highlands include Snow Gum, non-durable species of large size but low value in the Mountain Gums (*E. dalrympleana, E. viminalis*), and a species of medium durability in the Messmate (*E. phellandra*), to which various specific names such as *radiata* and *amygdalina* have been assigned at different times. Proceeding westward towards the central plains, the most important species is Red Stringybark (*E. macrorrhyncha*), a durable sleeper and pole timber, while *E. sideroxylon* occupies some of the lower foothills before the inland Cypress zone is reached.

North from the main southern highlands the the general altitude decreases and a large zone of lower rainfall extends towards the New England tablelands, the country being generally much broken and carrying a poor type of forest of miscellaneous species on the dry rocky slopes. The White Gums (*E. maculosa*, &c.), the Boxes (*E. melliodora*), polyanthemos *Baueriana* and *populifolia*, together with *E. dives*, *E. phellandra*, *E. rubida*, *E. viminalis* and numerous others, are present, and a Stringybark (*E. Blaxlandi*), a Grey Gum (*E. punctata*), with much *E. sieberiana* occur towards the coastal fall, while in the Blue Mountains under a higher rainfall *E. altior* occurs in limited quantities.

The forest value of this large belt of country is generally low, the timber being sawn but rarely. Its main use is for local settlement purposes, and, in the Lithgow coal belt, for pit timber. In the more fertile gullies tall trees of large size may be numerous, while on the red soil heights north, south and west of the Jenolan Caves are limited patches of well grown *E. fastigata*, which, however, is marketed with difficulty, if at all, and generally indicates conditions suitable for the production of exotic pines such as *ponderosa, laricio* and *insignis*.

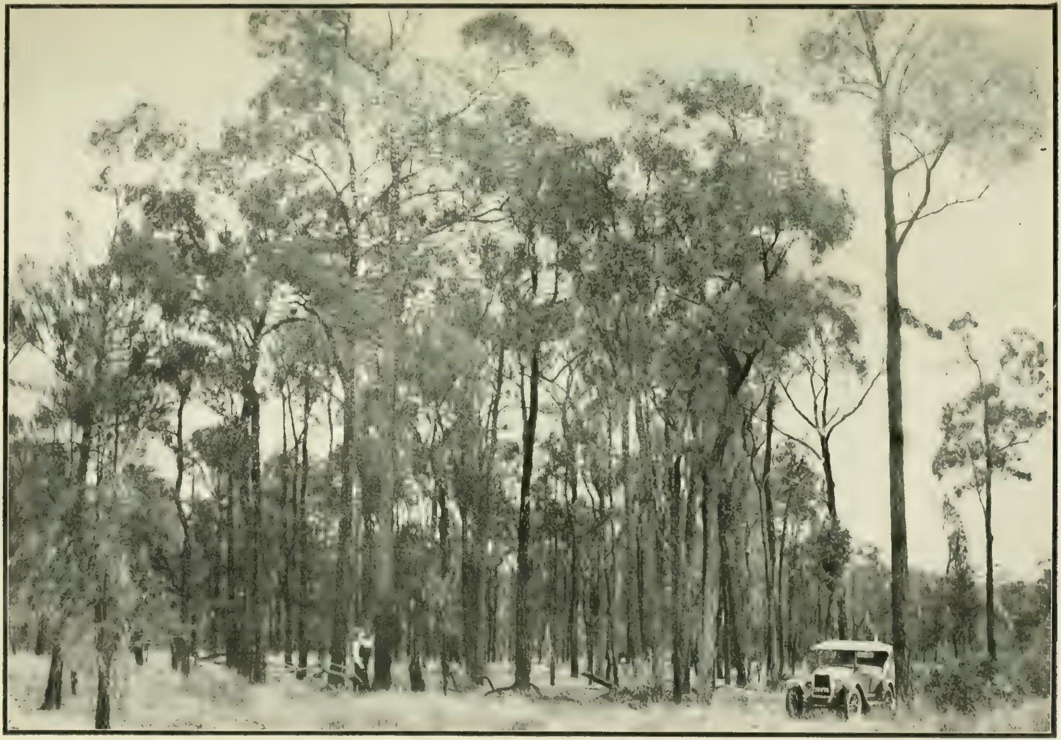
In the northern highlands, separated from the central tableland by a still drier belt, which is drained on the coast by the Hunter and the west by the Macquarie and Namoi Rivers, the conditions are very variable. The New England tableland, which rises to a height of over 5,000 feet at Ben Lomond, is comparatively cold and bleak and carries forest of low value, the most valuable species being the Stringybark (*E. macrorrhyncha*). To the eastward, in the mist belt before the land falls away in the precipitous gorges and barren slopes of the coastal ranges, a much more luxuriant type of forest occurs on narrow strips of red soil at altitudes of 3,000 to 4,000 feet. The main species are *E. obliqua*, *E. viminalis* and the New England peppermint (*E. Andrewsi*), all of which reach large dimensions, while forms of *E. eugenioides, Blaxlandi and Muelleriana* also occur. Rising from the coast to meet these colder climate species are to be found *E. microcorys* and a form of *E. saligna*, which thrive well in spite of the fact that they are subjected to occasional snowfall. The bulk of the sawn hardwood for New England has been derived from these mist belt forests, which still maintain a few small mills and are capable of yielding continuously at the rate at which they are now being cut.

At the northernmost end of these highlands the forest species change on the west to Cypress and its associates, and on the east to those of the Hoop Pine and Cedar Brushes, the Hoop of the Macpherson Range having for years been the main softwood used from Glen Innes to Warwick, in Queensland.

Inland Forests.

The Central Division of the State, though subject to a most uncertain rainfall, produced natural forest growth of much greater value to the needs of the community than the highlands, the species generally being characterised by much greater durability. That they have been very largely reduced in area and value is due to the progress made by the pastoral and wheat-growing industries in this division.

The most valuable hardwood species in the south, from the point of view of sawmilling, was the River Red Gum (*E. rostrata*), Australia's chief river

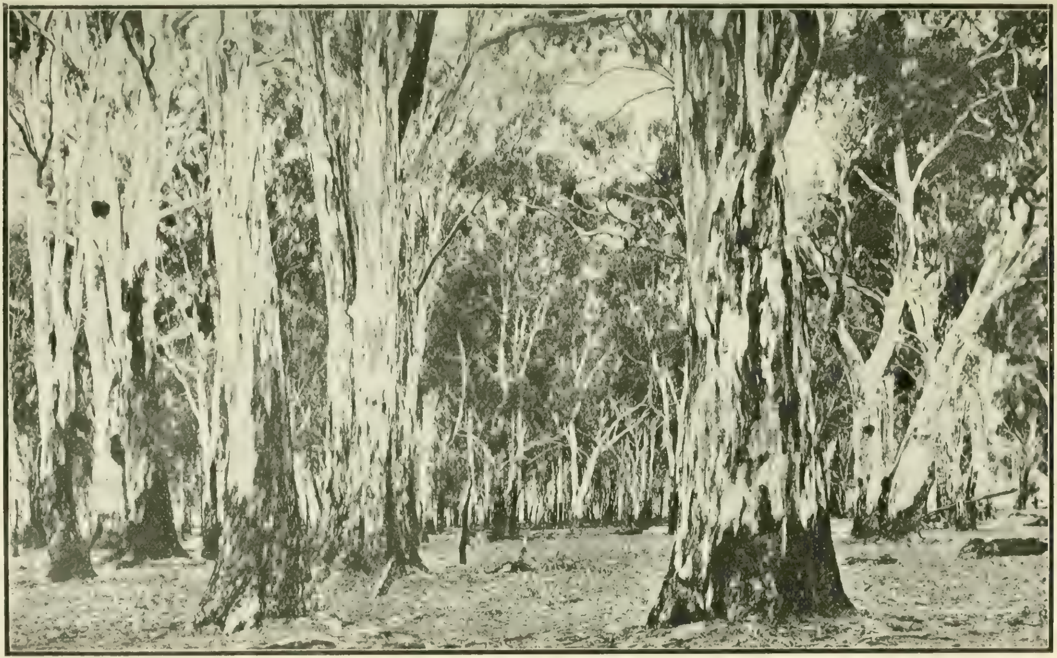


Inland type. Narrow-leaved Ironbark (*E. crebra.*)

and creek species, which, however, is a forest tree of importance in New South Wales only on the middle reaches of the Murray, east and west of the Victorian town of Echuca. In this locality, between the Murray and its anabranch, the Edwards, scores of thousands of acres are subject to annual inundations of greater or less depth, and consequently Red Gum forests have arisen there, whereas in other places the growth is generally confined to a narrow and comparatively valueless fringe of trees along the banks. In places along the Murrumbidgee, Lachlan, and other rivers, forest patches of less extent occur, but, as far as New South Wales is concerned, the Red Gum is of real forestry importance only on the Murray. The tree, though it may reach considerable height and yield poles up to 60 feet in length, is generally short-barrelled and of large girth, with a wide, spreading crown; it is the main source of sawn hardwood and railway sleepers for the poorly timbered areas on both sides of the Murray in Victoria and New South Wales. Associated with it on slightly higher ground are the Boxes (*E. melliodora*, *hemiphloia*, and *bicolor*), while on the sand ridges traversing the inundated areas the Cypress (*Callitris*) occurs.

North of the Murray to the Queensland border once stretched the large inland forest of eucalypts and *Callitris*, considerable remnants of which still exist. In view of the high temperatures experienced and the low and uncertain rainfall, varying from 15 to 30 inches, this forest reached its best development on the level or gently undulating agricultural lands, deteriorating greatly on the stony ridges and on the dry, porous, siliceous soils. The range of the *Callitris* extends from south to north and well into Queensland, but the distribution of the various species of Eucalypts varied according to the climate and soil conditions. In the south the chief hardwood species were Yellow Box (*E. melliodora*) and Grey Box (*E. hemiphloia*), indicators, as a rule, of desirable country for settlement, but their continuity was broken on the stonier ridges by an intrusion of the Ironbark or Mugga (*E. sideroxylon*), the development of which was frequently poor. In the northern half the two boxes are frequently replaced on the stiffer soils by the narrow-leaved Box (*E. pilligaensis*), but on the looser soils the Ironbarks become the predominant species. Of the Ironbarks the most valuable and the most exacting on soil and moisture conditions is the narrow-leaved Ironbark (*E. crebra*), which is main sleeper, girder and pole timber of the interior now that the Grey Box has been so largely destroyed in the interests of grazing and wheat. Associated with this species and occupying also the poorer sites are *E. sideroxylon* and the glaucous variety of the broad-leaved Ironbark (*E. siderophloia*), both of which are much more subject to decayed and hollow hearts than *E. crebra*.

The Ironbark areas of the northern half of the Central Division are less favourably situated as regards a wheat-growing rainfall, while, in addition, they were devoted more to cattle-raising than the southern areas, and, consequently, these hardwood resources were not destroyed so extensively as the Box of the south. Considerable areas of mixed Cypress and Ironbark of moderate to low value, and aggregating 1,000,000 acres, still remain to the Crown in the Pilliga forests south-west of Narrabri, and the Goonoo forest north-east of Dubbo, but their effective area is decreased by numerous and extensive "Broom plains" on the sterile soils peculiar to the districts, and by the Belah (*Casuarina Cambagei*) and Brigalow (*Acacia harpophylla*) belts on the black soils. Infestation by prickly pear in the Pilliga areas is extensive and serious, though control by insects and poisoning is now being established.



Open forest of Red gum (*E. rostrata.*)

The two chief species of *Callitris* common to this inland zone are the White (*C. glauca*) and the Black (*C. calcarata*), the former, owing to the white ant resistant properties of its timber, being the staple house-building timber of the interior, while the latter, being far less resistant and less durable, is only in demand where nothing else is available. The White Cypress naturally affects the better, and the Black the siliceous and more stony soils, while the latter penetrates further to the east into the highland belt, especially on the rocky granite ranges. The younger sapling stands of the former were severely over-thinned in early years in the interests of sheep grazing, which, at the present time, coupled with the influx of the rabbit, effectually prevents the establishment of reproduction. The Black, on the other hand, reproduces more freely and is less affected by grazing animals, with the result that on the stonier slopes it has for many years been displacing its associates, of which *E. sideroxylon* is one of the most important.

These mixed forests of *Callitris* and Eucalyptus contain also a large proportion of Bull Oak (*Casuarina Luehmanni*), a hardy xerophytic species, which, in some cases, almost monopolises the stand, and which is of importance as yielding the best firewood of the interior, its sylvicultural value not having been the subject of investigation.

The Western Division of the State, with a rainfall below 15 inches, does not figure in the question of timber production, except for the limited fencing and firewood supplies required for the scattered population. Species such as Mulga (*Acacia aneura*), Wilga (*Geijera parviflora*), Sandalwood (*Eremophila Mitchelli*), and the Quandongs (*Fusanus, spp.*) are valued primarily as fodder trees which should be utilised for other purposes only after their death by natural causes. In the eastern part of this division Cypress occurs and Red Gums and Boxes fringe the courses of the rivers, but attempts to grow any species for the production of wood do not seem to be justifiable or to offer any prospects of success economically.

GENERAL REVIEW.

The development of forestry in New South Wales has been seriously hampered by a number of causes on which it is not necessary to enlarge, but one aspect which must have assisted to render it unimportant in the opinion of Governments was the apparent superabundance of supplies. The total area of the State east of the Western Division is in the neighbourhood of 130,000,000 acres, most of which, in its natural condition, was covered with forest or woody growth of one form or another, frequently of low quality certainly, but amply sufficient to give the impression to the ordinary observer that supplies were "unlimited." The capital, Sydney, had always contained a large percentage of the population of the State, and for many years could always obtain an abundance of first-grade hardwood at low prices, while the ease with which the capital could obtain ample softwood supplies at low prices from overseas was such that importing became a fixed habit to be accepted as the natural thing. The second large centre of population, Newcastle, was even more advantageously situated, for, in addition to being on the coast and nearer the main hardwood forests, it had abundant deposits of coal, which effectually disposed of any difficulty as regards firewood supplies from the forests.

Seeing that the rest of the population was scattered throughout a State containing such an apparently large forest area, it is not surprising that the people's vision did not penetrate the future, or examine critically the accessibility and quality of the forest resources which would remain when the best and most readily accessible were destroyed or exhausted.

In the Central Division, industry was, in the first place, mainly pastoral, with extremely small requirements except for fencing, so that only fencing timber and a very limited quantity of Cypress for building were valued at all. The rest of the timber was not only superfluous, but, by keeping down grass, greatly reduced the carrying capacity of the land, so that extensive ringbarking, followed by the destruction of all "sucker" growth or reproduction, became the established practice. With the spread of wheat-growing, the density of the population increased greatly, but still the supplies seemed inexhaustible and clearing took the place of ringbarking, especially on the Cypress areas. Supplies of timber from areas to be cleared and from the Crown lands still available were ample for the purposes of railway construction—sleepers, girders, poles, &c.—and no thought was given to the time when renewals would be called for. Firewood was and still is abundant, so much so that to-day, even in spite of the forest destruction, fuel from forests can with difficulty be disposed of at 6d. per ton on the ground, and then only in isolated cases. Whenever people, and even the Forestry officers, discussed the question of future supplies, obviously exaggerated ideas were held regarding the rate of growth of indigenous species, and as short a period of twenty years for the production of Cypress trees of 30 inches girth was cited, when measurements for two or three years would have quickly disposed of this fallacy and shown that, in the most favourable localities, the rotation cannot be less than 100 years.

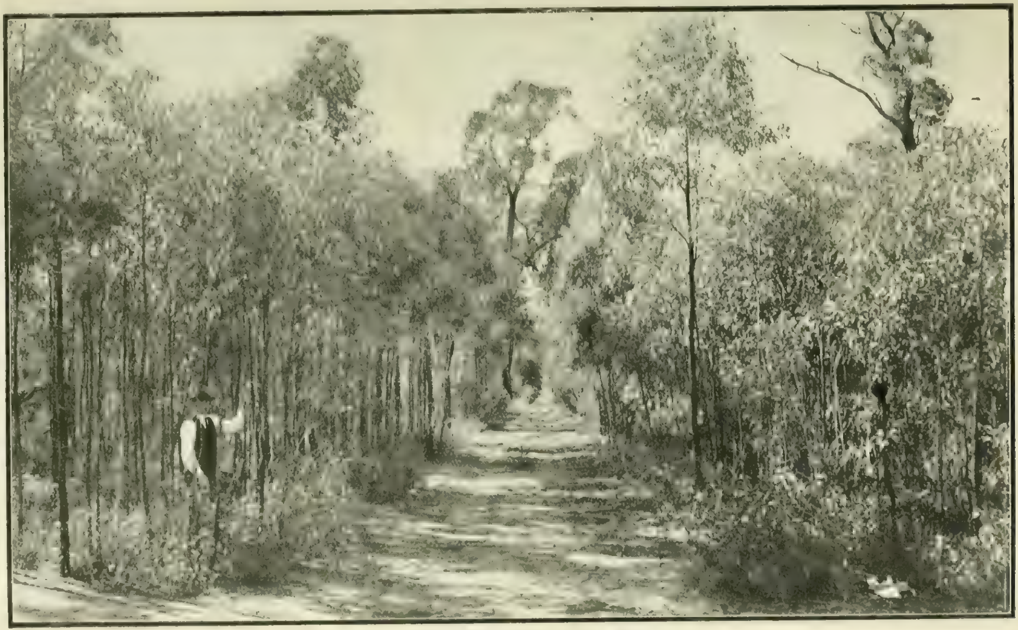
As a result of lack of understanding and foresight, the bulk of the railway sleepers required for renewals in the southern half of the interior have now to be railed from long distances, and though the supplies of Cypress mill logs from alienated lands have been adequate for local needs until quite recently, sawn timber from the north-west is now being drawn upon to meet the needs of a growing community in the south. It appears almost certain, in fact, that the majority of the State forests still retained for the production of Cypress will not support sawmills indefinitely, but will be managed for the yield of poles rather than for log timber. The northern Ironbark and Cypress forests, having been operated on less extensively and been less affected by settlement, are better stocked with marketable timber at the present time, but are quite unable to supply for many more years the needs of the whole of the interior, while, on the other hand, the over-supply of firewood and fencing timber is much more evident there than in the south. The State generally, in fact, is in the position that only high-grade produce is required, while the bulk of the stand is low grade, due, of course, to the preponderance of forests of broad-leaved species, which always yield a comparatively high proportion of fuel, even when well grown and intensively managed.

The forestry position in the highlands is not, and cannot, for many years, be expected to be satisfactory, on account both of the large areas of sparsely populated land and also of the class of forests which they carry and the cost of transport. No difficulty is met with generally in providing the necessary durable fencing timber for local needs from selected lands, but, in any case, the prices for this class of produce allow for little more than the cost of haulage and conversion, so that any trade therein does not encourage forest management. When it comes to the question of mill timber, the forests provide a striking example of the low value of areas of non-durable hardwoods when put to uses for which conifers are far better suited. The expenditure involved in milling and hauling this class of timber from forests which do not yield sufficient first-class material per acre to justify up-to-date mills or railway construction is such that effective competition with softwoods is impossible. Though conditions may possibly be improved by raising the tariff barriers, or by the naturally increasing prices of oversea produce, even then it seems undesirable from the economic standpoint to concentrate on perpetuating these species when conversion into conifers will bring higher returns and yield the class of timber which is required in greatest abundance.

The hardwood forests of the coastal zone also provide an instructive example of the influence of local population upon the practice of forestry. Practically ever since its inception the coastal timber industry has been dependent upon railway requirements, the needs of Sydney and Newcastle, and a varying export trade, the demands of local settlement being far too limited to utilise even a small fraction of the abundance of timber on selected lands. The sawmilling, as well as the hewn and round timber trades, developed on the basis of filling special orders primarily, and the scantling or market sizes, the production of which cannot, of course, be avoided, were looked upon as surplus to be disposed of at the best prices possible to city timber yards. The apparently unlimited supplies available meant low prices to the State or other owner of the standing timber, while the filling of special orders resulted in the continual picking of the best species and the best trees in all stages of growth. In the absence of extensive local markets, second-grade produce, which could not pay the costs of conversion and transport to more distant centres, was unsaleable, and the inevitable result was, except in specially favourable cases, a steady deterioration of the forest stand, both as regards species and quality of individual trees, this being accentuated by periodical fires. Durable species, such as Grey Ironbark and Tallow-wood, which were saleable from pole sizes upwards, naturally tended to disappear from the stand and to be replaced by such species as the less durable Blackbutt and Red Bloodwood, the latter, though very durable, having been generally rejected in earlier years on account of gum veins. Even at the present time the special order trade is the mainstay of many of the mills, and though the smaller towns are growing in size their requirements are still far from sufficient to ensure satisfactory utilisation. Consequently the position with regard to timber supplies throughout all the well timbered parts of the State may be summed up as showing a growing scarcity of high grade and a comparative abundance of low-grade produce.

STATE FOREST AREA AND VALUE.

The provision made for the future supplies of the State, amounting to over 5,000,000 acres, should not be judged by the acreage without a critical analysis of the productive capacity of the forests and of their relation to the main consuming centres. For fifty years past, though the interests of settlement have predominated, the proclamation of reserves for timber supply has been the subject of more or less attention, though not by any means always with a view to the protection of forestry interests. Underlying the original reservations of Red Gum forests on the Murray, for instance, there was, no doubt, a desire on the part of the early landholders to have extensive runs for stock, freed from the menace to them of subdivision into smaller holdings, while, in the aggregate, large areas of land



Dense reproduction of *E. crebra.*

were reserved for timber primarily because they were too rough, inaccessible or poor to support settlement. When the Act of 1916 laid down that the area of permanent State forest was not to be less than 5,000,000 acres, the hasty classification which was made threw considerable areas of this hopelessly unproductive land into the schedule, as is shown by the fact that revisions since that time have led to the revocation of over 850,000 acres.

Apart from this, the choice of forest areas was hampered by the allotment of a definite quota to each district, with the result that poor forest was included in one district to make up its quota, and far better growth in another was excluded. Consequently revision of State forests is proceeding continually, and at each session of Parliament resolutions providing for revocations are generally laid on the table; but at 31st December, 1927, the area of dedicated State forests was 5,313,865 acres. Judged by the percentage allotted to forest lands in most civilised countries, this acreage, constituting as it does only 2.7 per cent. of the area of the State, must appear small, while based on the argument that about ¾ of an acre of forest is necessary per head of population, it is sufficient to support about treble the existing population. This, of course, leaves out of account forest land in private ownership, but, in any case, comparative figures of this nature are of very little use unless the yield capacity of the forests and the proportion of the yield which can be utilised are taken into account.

Determination of yield capacity is a subject for the more distant future, but in order to give a general indication of the position the following extract from the last report of the Forestry Commission is quoted:—

> State forests have been classified into—(*a*) Hardwood, (*b*) Cypress, and (*c*) Miscellaneous Brushwood, including Hoop Pine, and the hardwood areas further subdivided into three quality classes, 1, 2, and 3. Quality 1 includes areas which are capable of producing dense forests of large timber, and on which growth is comparatively rapid; quality 2 covers areas producing slower growth and suitable for the supply of poles or small logs, while quality 3 comprises inferior forest fit only for the production of firewood and fencing timber, but still necessary for local needs.
>
> The classification, though necessarily somewhat indefinite, indicates, with sufficient accuracy for the purpose, that the hardwood areas embrace 4,100,000, the Cypress 750,000, and the Brushwood 450,000 acres. Of the first named, about 900,000 acres are classified as first quality, while second and third qualities comprise about 1,600,000 acres each, of which a small proportion, in the colder regions chiefly, is eminently suited for conversion into first-quality coniferous forest. A very large area of these low grade forests can only be regarded as a reserve for the future needs of a growing community, for millions of acres of alienated land carrying far better and much more accessible forests have been, and will for years be sufficient for local needs in many districts. At a later date they may form the nucleus for a system of municipal or shire forests to be managed more economically by local bodies, but, at present, any attempts by the Commission to manage them would only entail heavy expenditure without any prospect of adequate return, and attention has, therefore, to be concentrated on the best areas only.

As regards the utilisable proportion of the yield, it has already been stressed that a large percentage of the produce of the hardwood forests, being low grade, cannot be marketed at present, and, though in the future, conditions will no doubt improve considerably, the situation of the forests with regard to the population will be an important factor for many years. Generally in the rural districts the location of the forests in relation to the main centres of consumption is satisfactory, but, unfortunately, for many reasons, the rural population forms too small a percentage of that of the whole of the State.

More than half the population is contained in Sydney and within a radius of 100 miles, as in Newcastle, the South Coast and Hunter River coalfields, the industrial centre of Lithgow and other towns, and within this range the main geological formation is the Hawkesbury sandstone, than which there could not be much worse timber producing country. Belts of good forest certainly occur within this radius and supplies of firewood and mining timber are comparatively abundant, but, speaking generally, the main portion of its timber supply must be drawn from outside, involving expensive rail or steamer freight which can only be borne by high-grade produce. So long as this obtains the location of the coastal forests with regard to the population cannot be deemed satisfactory, but the position will be improved if and when more railways are constructed to link up the coastal districts with those on the highlands.

Timber Reserves.

In addition to the State Forests dealt with above, there are 1,537,000 acres of temporary reserves of greater or less value, which, on the whole, cannot be said to bulk largely in the forest resources of the future. Future classification will, no doubt, reveal areas which are worthy of permanent reservation, but it is not to be expected that the proportion of first-class indigenous forest will be greatly increased.

DISPOSAL OF CROWN TIMBER.

Historical

For many years the disposal of Crown timber was not regarded seriously by the authorities, the value of round and hewn timber being merely the cost of the production and haulage plus the supplier's profit. The first step towards the control of operations was the provision that those engaged in obtaining Crown timber should hold licenses, for the issue of which small sums were charged, though this was really a form of revenue collection and had no regard for the welfare of the forests. At a later date, with a view to increasing the revenue, the licenses contained provisions that royalty should be paid on the timber removed, the history of the development being contained in paragraphs 10 to 15 of the final report of the Royal Commission on Forestry published in 1908 and reprinted as follows:—

> 10. Before dealing seriatim with the matters referred to us for investigation, it would, perhaps, be desirable to give a short history of forestry in New South Wales. By the early settlers our forests were apparently regarded more in the light of a nuisance than as a potential source of wealth, the best land being, as a rule, heavily timbered, the forest growth on it had to be felled, burnt, and cleared, before any attempt could be made to cultivate. No doubt our forests appeared to them to be inexhaustible, and probably it was not thought that a time would come when the supply of timber from our native forests would be insufficient to meet our own needs. The increase in our population, the consequent growth of our towns, and the extension of trade and manufactures, have created an ever-increasing demand for timber, whilst the increased settlement on the land, the inevitable process of clearing and ringbarking, with the consequent destruction of the forests, have considerably reduced the timber-producing areas. The Government of the day only sought to use the forests as a means of producing revenue to the State, and therefore we find that for nearly a hundred years after the foundation of New South Wales the only effort put forth in connection with forestry was in the collection of license fees from timber-getters; meanwhile, vast sections of country which were formerly covered with magnificent forest trees, were entirely cleared of timber. As far back as the year 1839 the Government issued rules and

regulations under which men were permitted to obtain licenses authorising them to cut and remove timber from vacant Crown lands on payment of nominal fees, the authority to grant such licenses being vested in Crown Land Commissioners and local magistrates. As, however, only a small portion of our land was then settled upon, it naturally followed that the regulations had a very limited application, for in the outlying districts there were neither commissioners nor magistrates to issue licenses, or to punish defaulters for working without them. In the year 1850 new regulations relating to timber-cutting on Crown lands were issued under the hand of Mr. E. Deas-Thomson, the then Colonial Secretary. These regulations were more comprehensive and stringent than those previously in force, and required that a separate license should be held by every person actually engaged in felling, cutting, sawing, splitting, or removing timber from Crown lands. The licenses were issued and the fees collected by the Commissioners of Crown Lands, by whom the regulations were enforced. The duties of these officers were simply to collect fees from the timber-getters and see that no one removed timber from Crown lands without a license. The licensee, however, was practically left to do as he wished in the forest. He felled what trees he liked, removed what pleased him, and left on the ground to rot what did not suit him.

11. The evils caused by this condition of affairs became so great that the Government had at last to intervene in order to arrest the process of destruction and preserve some of the rapidly diminishing forest areas of the State, and in 1871 the first timber reserves to protect forest lands from alienation were notified. Up to this time it appears to have been an unwritten law that any man who felled a tree owned it, and, in the absence of any definite legislation, the magnificent cedar forests of the State were largely despoiled. In 1877 forest regulations regarding the cutting and use of timber were made, and a small branch for administrative purposes was established. This branch was first attached to the Lands Department. In 1878 it was transferred to the Department of Mines; in 1888 it was again attached to the Lands Department; in 1889 it was proclaimed a Department, and placed under the care of the Colonial Secretary; in 1892 it was again transferred to the Department of Mines, and in 1897 it was re-established as a branch, and attached to the Lands Department, where it at present remains. Probably no section of business under Government control has experienced greater vicissitudes in its management or less consideration than that connected with our forests. No attempt appears to have been made to lay down a policy of management, and apparently as each responsible department became tired of the business, or failed to succeed with it, it was passed on to another. Whatever variation in matters of detail might have been caused by these Ministerial changes, the protection of the forest domain appears to have been nearly always subordinated to the policy of settlement. No matter how poor a tract of land might be in the quality of its soil, or how good the timber, the latter consideration apparently weighed but little if settlers fixed a covetous eye on it and pressed for its alienation. It is not surprising, therefore, that the neglect to discriminate between land fit chiefly for forests and land fit for successful settlement has resulted in the State losing vast areas which at the time of alienation bore first-class hardwoods and pine, as well as in many instances cedar and other brushwoods of great value.

12. From its inception the laws relating to forestry, and under which it has been administered, were those designed for the occupation and settlement of the public estate, and embodied no aim for the maintenance of forests in perpetuity or for their treatment on scientific or systematic lines, nor did they include any policy of conservation or reproduction. The working code or regulations issued under these laws were largely ineffective, and differed little in detail until the year 1902, when the first effective steps in the direction of protecting immature forest growths and in systematically checking the exploit of forest products were taken.

13. Between the years 1877 and 1880 users of timber were charged a moderate license fee, the license being for the purpose of registration, and the fee to represent the value of the product taken. From 1881 to 1886 this fee was slightly increased, and in some instances a moderate royalty was charged. During the intervening years, up to 1901, the royalty principle was greatly extended, and in 1902 royalty on a higher scale than at any time previously charged was generally adopted as the basis of payment, the license being issued purely for registration purposes and at a nominal fee.

14. The following is a statement of the revenue obtained and the expenditure incurred in connection with the Forestry Branch since its formation in 1877:—

Year.	Revenue.	Expenditure.	Surplus.	Deficit.
	£	£	£	£
1877	4,324	4,579	......	255
1878	5,935	5,593	342	......
1879	7,946	5,920	2,026	......
1880	8,990	6,635	2,355	......
1881	10,812	7,093	3,719	......
1882	13,047	12,592	455	......
1883	16,686	15,340	1,346	......
1884	18,250	17,481	769	......
1885	13,863	18,146	......	4,283
1886	14,607	17,932	......	3,325
1887	12,250	18,038	......	5,788
1888	19,728	19,505	223	......
1889	17,137	18,212	......	1,075
1890	15,437	20,779	......	5,342
1891	18,455	23,875	......	5,420
1892	16,176	24,635	......	8,459
1893	9,547	19,459	......	9,912
1894	6,333	15,533	......	9,200
1895	7,095	13,867	......	6,772
1896	8,727	8,356	371	......
1897	8,759	3,700	5,059	......
1898	10,952	3,136	7,816	......
1899	11,866	5,323	6,543	......
1900	14,421	5,101	9,320	......
1901	19,813	5,627	14,186	......
1902	31,872	10,639	21,233	......
1903	36,264	17,080	19,184	......
1904-5 (18 months)	51,243	24,303	26,940	......
1905-6	42,738	16,639	26,099	......
1906-7	50,397	20,259	30,138	......
1907-8	56,047	19,544	36,503	......
Totals ... £	579,717	424,921	214,627	59,831

15. From this statement it will be seen that the total revenue of the Forestry Branch since its formation in 1877 up till the end of the last financial year (1907-8) was £579,717, and the total expenditure £424,921, or a surplus of revenue over expenditure of £154,796. During the first eight years, from 1877 to 1884, the revenue exceeded the expenditure by £10,757; during the following eleven years, from 1885 to 1895, the expenditure exceeded the revenue by £59,353, and from the year 1896 to 1907-8, a period of twelve and a half years, there has been a continuous surplus amounting to £203,392.

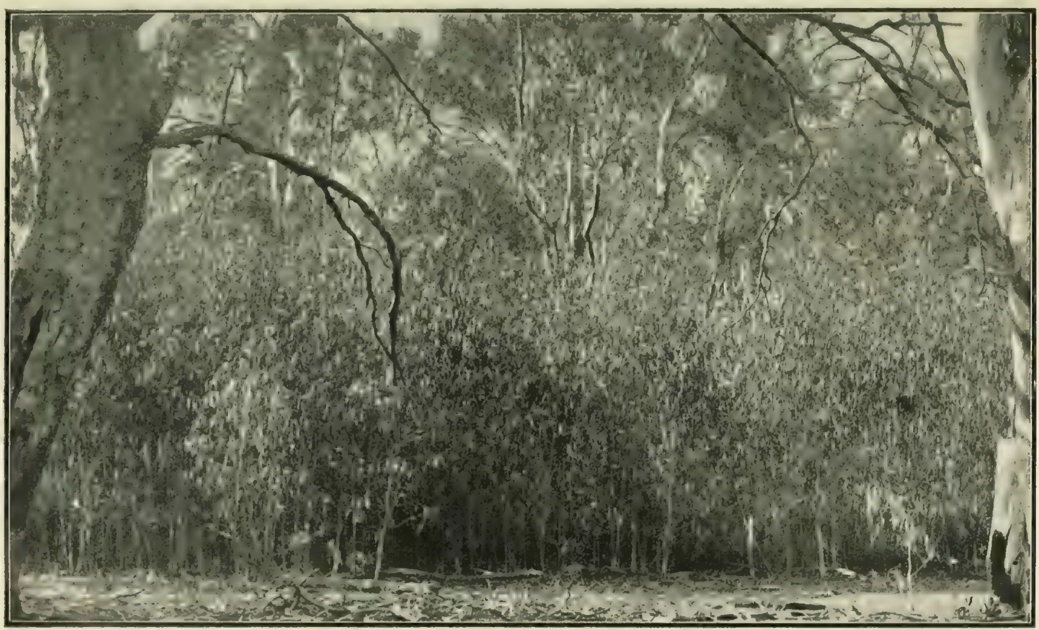
The fact that the forestry legislation and administration referred to in that report showed no conception of the business of forest management resulted in "timber royalties" being regarded by operators as a tax on industry, an impression which still persists even to the present day, so strong is the association between old established terms and ideas. Probably some years more will elapse before it is clearly understood that forestry is a State industry and that the State, as the grower of the raw material—the primary producer in fact—should expect to dispose of its produce at the market value without being regarded as imposing taxes on industry. That the members of the Royal Commission themselves had not very clear ideas on the subject is shown by the fact that, in recommending increased royalty rates, they did not take into account varying conditions throughout the State, and, except in one instance, proposed that flat royalty rates should be adhered to for each species or list of species, regardless of varying extraction, transport and market conditions. Flat royalty rates remained in force even after the passing of the 1909 and 1916 Acts, although the latter, by authorising the administration to fix prices above gazetted *minima*, recognised that sale values must vary; and it was not till 1918 that the Forestry Commission attempted seriously to arrive at market values and, where advisable, to submit Crown timber to public competition —a change which naturally evoked vehement protests from those accustomed to the old system.

Prices and Trade Conditions.

The long-established practice of fixing royalties by regulation has resulted in some curious anomalies which still exist, and, in one instance, prevent the Forestry Commission from obtaining revenue from railway sleepers commensurate with the intrinsic value of the timber supplied.

Foresters are accustomed to look to the quality increment associated with the increase in girth of standing trees for assistance in maintaining the interest rate on the forest capital when the decreasing rate of growth of older trees can no longer keep pace. Buyers of mill logs certainly pay, in some cases, according to girth, but the equivalent royalty rates per cubic foot established by Government regulation for timber derived from the smaller trees producing poles and piles are considerably higher than the rates paid for the larger mill logs. Consequently, in the case of all durable species saleable in the pole stage, it is extremely bad business from the point of view of the grower to attempt to grow them to mill log size, the quality increment being negative. It is not to be assumed from this that the rates for poles and piles have been too high—on the contrary they are still far too low—but it indicates rather that serious thought must be given in the future management to the advisability of not growing durable hardwoods to mill log size. The history of the disposal of timber from State forests is marked by persistently recurring complaints from the hardwood sawmilling trade concerning the excessive royalty rates on mill logs. How small they are in comparison with what some oversea foresters are used to is seen from the fact that whereas the Sydney retail prices for ordinary sawn hardwood range from 4s. per cubic foot upwards, the royalty rates vary generally from 1d. to 2½d. per cubic foot in the round, quarter girth measurement. The reason for the anomaly is that, as poles and piles, certain hardwoods are finding their best uses with no low priced competition, while in the milling trade the sawn product has to meet competition from cheap imported softwoods, steel, concrete and various wall and partition making compositions.

Rates on hewn sleepers and girders were established on the basis of mill log rates after allowance was made for the estimated average waste, and thus arose the further anomaly that prices round which suppliers tendered, and which have become more or less standard, were based on the average costs of hewing and transport plus profit and a little for royalty, and worked out sometimes at prices below those for sawn scantlings. Thus first class hardwood sleepers 8 ft. x 9 in. x 4½ in., containing 2¼ cubic feet, are delivered in railway yards for 5s., or at the rate of about 2s. 3d. per cubic foot, and yield a royalty in the square of about 2½d. per cube. Hewers and haulers can average good wages at the present prices, so that the payment of only



Extremely dense reproduction of Red gum (*E. rostrata.*)

another 3d. per cubic foot would be necessary to make the value of the sleeper in the forest about 1s.—which no forester could consider high in view of the quality and durability of the timber; and at 2s 6d. per cubic foot the sleeper would still be cheaper than the price of scantlings in many country centres supplied by sawmills in close proximity. In course of time these anomalies may perhaps be removed, but in any case it seems reasonably certain that, so long as Sydney remains the chief market for the hardwood scantlings produced by country mills, ordinary hardwood mill logs will always be of low value in the forest.

In marked contrast with the hardwood log values are the forest prices realised by the department for Hoop Pine and Cypress, logs or sawn timber of which not infrequently have to be hauled over 20 miles to railhead, whereas, until the advent of motor trucks, it was rarely that ordinary hardwood logs were hauled 10 miles. Certainly the mills cutting softwoods have their periods of depression in common with other industries, but their trade is generally much more stable than that of the hardwood milling industry. For many years, for some unaccountable reason, Hoop Pine, which is a softwood of the first quality, was rated low and its conservation neglected, official statements describing it as an inferior timber unable to compete with imported deals. Its value is, however, now fully recognised—though it is a fast vanishing resource—and the prices for standing trees vary from 3d. to 1s. 2d. per cubic foot, according to location, Sydney retail prices ranging upwards from 7s. per cubic foot for first quality boards.

The Cypress sawmilling trade was, for many years, conducted on the cheapest possible lines, and in a manner quite inconsistent with the forestry principle of sustained annual yield. With the object of saving log transport and hauling only sawn timber, travelling mills would set up on a forest, cut it out of mature or over-girth timber as fast as possible, and move on to the next site. To a certain extent this practice still persists, but it is discouraged as much as possible on State forests, on which the annual cut is now limited in many instances. Unfortunately the number of forests with a sufficient stand to support even very small mills is not great, and when the supplies on private lands are exhausted, the Cypress milling industry will be greatly curtailed. Until recent years Cypress was used only in the central and western districts, but considerable impetus was given to the trade by the high post-war prices affording it the opportunity of obtaining a footing in the Sydney and Newcastle markets. Numerous small mills sprang up in consequence, and the increase of the tariff on Baltic deals will enable them to continue on private supplies to the detriment of the future of the inland districts. Prices for standing Cypress range from 3d. to 7d. per cubic foot, and the rough, sawn product is placed on trucks at about 3s., Sydney retail price for dressed flooring being about 4s. 9d. per cubic foot. It is an interesting fact in the timber trade that, whereas Baltic deals and Cypress both sell readily in Sydney in spite of an abundance of knots, the knots in second grade Hoop Pine frequently make its sale difficult. For this reason the utilisation in the forest of Hoop Pine trees is much less satisfactory than that of Cypress, only the comparatively clean barrel of the former being taken and the rest, comprising almost the upper half of the stem, being left as unmarketable. There seems but little prospect of this state of affairs improving.

Prices received for such brushwoods as are saleable vary generally from 1½d. to 3½d. per cubic foot, the greater proportion being disposed of at the lower price, but Red Cedar brings from 6d. to 1s. 9d according to the difficulties of extraction, no remaining trees being now readily accessible. For this last species as much as 10s. per cubic foot has been paid, on trucks, for pit sawn flitches, but the quantities now cut are very small.

Forest prices received for poles and piles range upwards from 1d. per running foot for small poles, as much as 1s. 1d. per foot being obtained for rare specimens of lengths over 80 feet. Hewn sleepers and girders are disposed of at output rates, regardless of the volume of the standing trees, prices ranging from 2d. to 6d. per cubic foot, the latter for longer lengths and sizes the hewing of which entails much waste. Whereas in Queensland the use of round girders has been generally adopted by the Railway Department for many years, in New South Wales squared timber is always required, with the result that timber which in the northern State yields 17-inch round girders, all heartwood, is reduced to 12-inch squares in New South Wales, with the loss of much of the best timber in the log. In view of the growing scarcity of Ironbark, there is certainly room for economy in this direction, both as regards timber and price, the hewing of squares being more expensive than the sapping of round logs. It is an interesting fact also as showing the varying opinions on the quality of different timbers, that while the Queensland railways accept an 18-inch diameter Spotted Gum girder as an alternative to a 17-inch Ironbark, the use of Spotted Gum in squared girders is not allowed by New South Wales railways.

INDUSTRIES.

Extraction.

Forest extraction methods in this State have been, on the whole, confined mainly to the old-fashioned bullock and horse teams drawing log trucks with top or bottom loading, according to the established custom of the locality; but quite recently the introduction of motor trucks has made for economy in hauling and facilitated the utilisation of timber which previously could not be hauled profitably. Tram-lines and mechanical log-haulers are used in some instances, but exceptionally rather than generally and only occasionally with financial success. Better results might possibly have been attained in this direction if more attention had been paid to setting aside a sufficient area for each mill to develop economically instead of allowing indiscriminate and competitive felling by several mills on one area as has been the usual custom. Even so, in the few cases in which larger areas have been reserved for one plant, it is found that the topography of the country and the comparatively low yield per acre cut from the forests have rendered mechanical transport comparatively expensive. Many thousands of pounds may be sunk in capital expenditure on a plant which does not remove more than 2,000,000 superficial feet of log timber per year, so that interest and depreciation may entail a standing charge up to 5s. per 100 superficial feet on the sawn output before a wheel is turned. The extraction of the future will, it is expected, centre more and more on motor transport, which will, of course, entail much greater attention to grading and maintenance of roads and the prohibition of hauling in wet weather. At present, development in this direction is rendered financially difficult owing to the very scattered distribution of marketable timber in the cut-over forests.

Sawmilling.

Figures supplied by the State Statistician show that the number of sawmills operating in the State is in the neighbourhood of 550, and that the total output of sawn timber approximates to 15,000,000 cubic feet, representing an average annual output per plant of less than 30,000 cubic feet. These figures indicate clearly that sawmilling plants are generally operated on a small scale, and it is in fact exceptional for a forest sawmill—as opposed to the larger city mills—to turn out 100,000 cubic feet of sawn timber per year. As may be seen from the preceding remarks, this is due to the low yield derived from the forests and also to the number of plants being greater than the cut-over forests can supply or than is needed to fulfil local requirements.

Under such conditions cheap mass production is obviously out of the question and the sawmill efficiency met with in some countries cannot be expected here, though the closing down of many of the older plants for the benefit of those better equipped and situated would be advantageous to the industry as a whole. In any case, however, the reliance of the hardwood trade on special orders for its financial success must always operate against the cheap production of standard sizes, and the Cypress and Hoop mills have a decided advanage in this respect.

The loss on conversion of hardwod logs varies greatly, but may be taken to average, roughly, about 40 per cent., a figure which applies also to Cypress. Log contents are calculated on the quarter-girth system, with allowances for pipes and faulty hearts in unsound logs, and with a 4-inch square allowance even for sound logs of most hardwoods. Thus the percentage recovery of sawn timber works out at less than 50 per cent. of the actual volume of the log, but no figures are available showing the relation between sawn timber produced and the volume of the standing trees. Recovery from Hoop logs should not average less than 70 per cent. of the quarter-girth volume, but in the case of most brushwoods low percentages are recorded on account of the difficulty of disposing of off-cuts, and the fact that it has not yet been possible to compete with imported timbers in the box-making trade.

Although air seasoning of timber has been practised, more or less, for many years, serious attention has not been devoted to kiln drying until quite recently, but it is now becoming evident that the future of the hardwood industry will be dependent largely on the supply of seasoned timber.

In the production of sawn hardwood in large sizes for structural purposes, seasoning obviously did not enter seriously into the question, and the prices at which scantlings have to be sold does not permit of the miller incurring much expenditure on seasoning. With the greatly increased use of steel and re-inforced concrete in large buildings, the adoption of various substitutes for weatherboards, and a recent tendency to replace wood-blocking in the streets by other materials, the trade should devote greater attention to what is one of the best uses for which our hardwoods, viz., high grade flooring, stacks of which frequently have to stand for two years or more if a good product is to be turned out. To obviate the locking-up of capital in stacks for so long, kiln drying on modern lines must certainly be investigated thoroughly, while an additional reason is that, with the cutting out of the virgin forests of big timber, millers will have to rely more and more on the younger and smaller second growth, which, as shown by the experience with planted eucalypts in other countries, is not particularly easy to handle.

For lack of a Forest Products Laboratory to investigate the problems associated with kiln-drying the trade is as yet considerably handicapped in this direction.

Special Forest Industries.

Forest industries engaged in the manufacture of special articles are, unfortunately, not of great importance yet, and there is considerable scope for investigation into the possibility of substituting local for imported timbers and building up small rural industries.

The cooperage trade has for many years relied upon imported oak and Tasmanian Blackwood, though *Euc gigantea* was once used for the manufacture of staves. More recently limited supplies of this timber have again been obtained for this purpose, while the Crab Apple, *Schizomeria ovata*, and *Casuarina* have also been used.

Several country factories have been erected for the manufacture of handles of various kinds, and *Euc. maculata* and *gigantea* are most generally used for all except axe handles, but for this latter purpose no satisfactory substitute for American Hickory has yet been found. *Euc gigantea* is probably the best eucalypt for all special purposes and has been largely used for the manufacture of boat oars for many years. Recent attempts to use this wood for clothes pegs have shown that it is very suitable for the purpose, but as yet the enterprise has not been commercially successful. Its suitability for the manufacture of wood wool also is undoubted, but this industry still remains to be established.

The chief development of importance of recent years is the erection at Kyogle, in the extreme north, of a ply factory dealing chiefly with Hoop Pine, which is considered the best ply and match box wood of Australia. Strange to say, this factory also imports logs of Douglas Fir at a cost considerably higher than that of the local Hoop, it being able to do so because the public will pay higher prices for "Oregon" ply than for the superior local timber—apparently on account of the more striking figure of the former. The future of this industry must be largely bound up with the possibility of extending the manufacture of ply wood from other species, and, in this connection, it is of interest that use is now being made of one of the softer eucalypts, Flooded Gum—*E. grandis*—the sawmill market for which is by no means satisfactory. The most recent proposal in the the same direction is the erection, by a piano-making company, of a veneer plant in the Coachwood forests of the Dorrigo.

Minor Forest Products.

Industries connected with the minor forest products have not been developed extensively in New South Wales.

Wood distillation was attempted at one factory on the North Coast—at Kendall—but without success and it was abandoned some years ago.

Charcoal burning is carried on intermittently at a few places where the product is absorbed by small suction gas plants, but it has not been of sufficient importance to have any appreciable effect on the utilisation of the abundance of waste wood in the forests. Burning operations are more continuous in the Red Gum forests of the Murray than elsewhere.

Eucalyptus oil distillation has gone through several phases, and, though only a very small industry, is probably more stable now than at any time in its history—due mainly to the increased demand for the phellandrene oils which are yielded by the *Euc. dives* group, and are the base from which thymol and menthol are now being manufactured. Formerly oils from this group were used chiefly in the flotation process of ore separation, but the demand for this latter purpose is no longer large.

The collection of the resin of the grass trees—*Xanthorrhea spp.*, which was in evidence in pre-war years, has not since regained prominence, while efforts to utilise the starchy products of "Macrozamia," which occurs so abundantly under the Spotted Gum forests of the South Coast, have not been successful.

The State is rich in tan barks, which are, however, generally of lower percentage than is acceptable to the leather trade at present. The most abundant are, of course, the Acacias, of which varieties of *A. decurrens*, particularly *millissima*, produce practically the whole of the commercial supply. This industry is the most important of all the minor industries associated with the forests and is located mainly in the South Coast, where the barks yield a higher percentage of tannin than elsewhere in the State. The Black Cypress—*Callitris calcarata*—yields as high as 30 per cent. tannin, but owing to colour and other trade difficulties its bark has not been successfully placed on the market. Systematic cultivation of wattles is not practised, except in a small way, the main supplies being obtained from naturally grown trees in the forests of private lands.

From the point of view of revenue, the product which comes second to timber is grass, rents from leases and permits amounting to about £26,796 per year. The grazing in the denser coastal forests is of considerably less value than that in the inland districts, the former being more suitable for cattle and the latter for sheep. Grazing will continue for many years probable to occupy second place, and will not decrease in importance until effective measures are taken to restore the normal forest density of the inland areas. As mentioned previously, a not unimportant feature of the grazing of the southern highland forests is their use in times of severe drought in the interior for the relief of starving stock.

THE FORESTRY ACT AND ADMINISTRATION.

It will be evident from the preceding that the development of the practice of forestry and the growth of the forestry spirit in New South Wales have been slow.

Following on the report of the Royal Commission on forestry in 1908, the passing of the Forestry Act of 1909 created a Department which functioned till replaced by the Forestry Commission created by the Act of 1916. The 1916 Act provided for the appointment of a Commission of three members, each of whom was to hold office for seven years; but an amending Act shortly afterwards provided for the temporary expedient of two Ministers of State acting as honorary Assistant Commissioners pending the choice of Commissioners other than the Chief Commissioner. Only two full Commissioners were appointed up to the end of 1924, when an additional amending Act coming into force in April, 1925, substituted a single Commissioner for the Commission of three members.

Part I of the amended Act now in force provides for the appointment for seven years of a Commissioner, who may be reappointed for a further like term, but whose term of office shall be deemed to have expired upon his attaining the age of 65 years. The Commission is given full powers of control and management of State forests and timber reserves, and may undertake the conversion of timber, the construction of roads and railways, the chartering of vessels, the management of sawmills, the purchase and grazing of stock, &c. All revenue collected is to be paid into the Consolidated Revenue Fund, whence one-half is carried to a special Treasury account to be expended under the control of the Commission on the management of forests—with the proviso that an amount exceeding £5,000 may not be spent except with the approval of the Minister for Forests.

The effect of Part I, therefore, is that the Commission has independent powers of forest management, but may not embark upon sawmilling, &c., in anything but a small way, except with the approval of the Government.

Part II, which deals more with Ministerial functions and control, provides for action by the Governor authorising the resumption, purchase, and exchange of land for State forest and access thereto, and the dedication of land as State forests, which may not be revoked except after resolutions in both Houses of Parliament. It also fixes the minimum area of State forests at 5,000,000 acres. With the concurrence of the Secretary for Lands, the Minister may also recommend to the Governor the temporary reservation of land as timber reserves, revocation of which is possible by notification in the *Gazette* without reference to the Houses of Parliament.

The administration of such existing land leases as are wholly covered by State forests or timber reserves is vested in the Minister, who for this purpose has the powers of the Secretary for Lands.

Part III authorises the Commission to issue licenses to operate sawmills and to dispose of Crown timber under license, provided that the term of a timber license shall not exceed five years except with the approval of the Minister, and shall not in any case exceed ten years. It also empowers the Commission to fix the royalty rates on forest products provided that such are not less than the minimum rates which may be gazetted under the regulations.

Part IV empowers the Commission to issue grazing, occupation and ringbarking permits, and forest leases also, the last-named, however, only with the approval of the Minister and for terms not exceeding twenty years.

Part V is general and supplemental, providing for penalties and procedure and for the making of regulations by the Governor. Under this part reference is made also to the Commission undertaking the inspection and branding of timber in order to ensure that purchasers obtain timber true to name and up to the specifications required.

For administrative purposes the whole of the State, excluding the Western Division, is divided into thirteen forestry districts in charge of district officers, who may be district or senior foresters according to the greater or less importance of the area under their control. Each district is subdivided into ranges or subdivisions, the field control of which is entrusted to foresters working directly under the instructions of the district officer, while, in localities where the timber resources are of minor value, supervision is entrusted to officers of the police force. The total number of foresters' ranges is forty-nine, varying from two to eight in a district, and requiring, in some cases, the appointment of a senior forester to assist the district officer in their supervision. Between the Commissioner and the district officers are the Chief Inspector and three other inspectors, while, in addition, special officers are engaged on forest survey and assessment, soil surveys, classification inspections and subdivisions. The total staff comprises ninety field officers, together with forty-nine clerical and administrative officers in the central and district offices, while forty-four police officers are appointed as acting foresters.

Under the conditions previously existing, when the Department was concerned primarily with administering the Act and regulations in force for the time being, the administration was largely decentralised. The disposal of forest produce not being subject to directions or working plans issued by Head Office, except as regards the flat rates fixed by regulation, it followed that the chief responsibility for the sales policy devolved on the local officers, generally those in charge of the subdivisions. In 1918, however, the Commission began to exercise authority and to regulate the disposal of produce, to a certain extent according to the principles of forest management. Forest survey and assessment parties were employed from 1916 onwards, and in a few years sufficient information was available concerning the most important areas to enable the Commission to lay down simple working plans of a general nature to guide the district officers. In the absence, however, of a definite Working Plans Branch, and owing to the impracticability of securing satisfactory working plan control, further progress in this direction has been checked. The institution of a Working Plans Branch is the most important administrative development now required, and, though considerable delay has been occasioned through the difficulty of obtaining the services of an experienced officer to take charge, the creation of the branch has been approved.

REVENUE AND EXPENDITURE.

Revenue.

The forestry revenue for the year 1927—the highest on record—amounted to approximately £246,000, of which nearly £27,000 was derived from grazing and about £8,000 from miscellaneous license, permit and inspection fees. Sales of standing timber realised about £193,500, and of timber converted departmentally about £17,500. The three most important revenue-producing districts were Kempsey, on the North Coast (£44,500), which, besides being one of the main centres of the hardwood trade, contains limited quantities of higher-priced Hoop Pine; Narrabri, in the north-west (£39,700), which produces the greater part of the hewn Ironbark of the interior and has the largest Cypress resources; and Deniliquin, in the south-west (£39,400), which produces mainly Red Gum and also Cypress. As stated in the last report of the Commission—

> Developments in the trade are, of course, difficult to forecast, but the maintenance of the revenue above £240,000 over a number of years will be difficult, for the only classes of timber realising prices which can be regarded as satisfactory are Hoop Pine, Cypress, and Hardwood piles. The supplies of these are diminishing rather than increasing, and in the course of ten years or so, the revenue will be dependent much more than at present upon the prices obtained for hardwood logs, poles and sleepers, which at present show no signs of improvement.

Prior to the passing of the 1916 Act, the highest revenue obtained amounted to £99,332 in 1913-14, after which it declined, amounting in 1917-18 only to £70,969. Later increases have been due, primarily, to the grazing revenue on State forests being credited to the Forestry Commission instead of the Lands Department, and to the abandonment of the old principle of applying flat royalty rates, this having had a marked effect on the revenue derived from the more valuable Hoop and Cypress. Rise and fall since 1917-18 have been as follow:—

Year.	Revenue.
1918-19	97,592
1919-20	147,040
1920-21	190,742
1921-22	217,841
1922-23	168,698
1923-24	186,393
1924-25	209,733
1925-26	224,207
1/7/26-31/12/26	111,311 (six months)

Expenditure.

The expenditure, which amounted to £194,000 for the year 1927, shows an unduly large sum spent on administration—about £71,500—in comparison with the revenue collected and the total spent on Forest survey and development (£117,500). The disproportion between the administration costs and the revenue is due primarily to the low prices received for hardwoods and the scattered nature of many of the operations. This in turn gives a wrong impression of the relation between administration and forestry work performed, for only a small proportion of the staff is actively engaged in the supervision of sylvicultural operations. As the scope of forest management is extended the position in this respect will improve.

The last report covered a period of eighteen months, and taking two-thirds of the figures contained therein as representing those for 1927, the expenditure on forest work was allocated approximately as follows:—

Forest assessment and survey £8,000, Land Resumption £14,400, Utilisation costs £9,000, Management and protection of indigenous forests £39,000, Afforestation (including capital costs) £44,000.

FOREST MANAGEMENT.

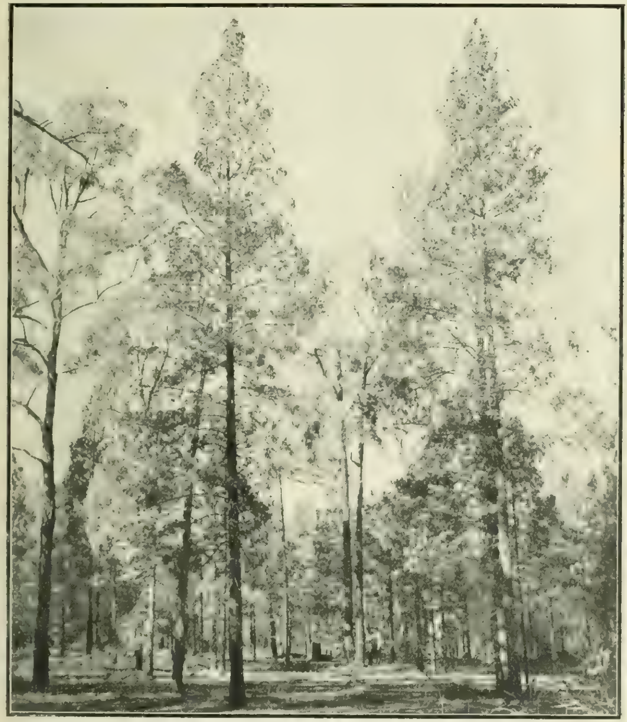
The preceding statements made concerning the conditions of the forests and the trade generally show that attempts at forest management are of recent date, and that, consequently, the practice of systematic forestry is largely a matter of future development. to which both the forestry service and the operators in the forests must be gradually accustomed. Progress in this direction has been unavoidably slower than is desirable, not only because of the trade conditions, for a special order trade and cutting cycles do not fit, but also owing to the lack of sufficient trained foresters who, while clearly understanding the final objective, have the requisite experience of conditions to meet the numerous problems that continually arise.

Hardwood Forests.

Half a century of forest exploitation which required only the payment of license fees or royalty accounts, or both, to make them legitimate and satisfy the administration, naturally developed amongst timber-getters and others a roving tendency which was not to be adjusted to suit the principles of forest management in a day, and more satisfactory utilisation of the mature and over-mature trees on a compartment is still practically the main though very elementary feature to which supervision has to be continually directed. Also the superfluity of low grade produce, already enlarged upon, brings to the fore the great importance of the Service striving incessantly to find a remunerative market for the over-mature and badly formed trees which make up such a large proportion of the stand, and whose utilisation or destruction is necessary if the forests are to be made really productive.

E. pilularis **in need of thinning.**

In the most accessible forests, which have been operated upon for so many years by licensees whose only object was to pick the best and most easily extracted trees of saleable size and which have been subject to numerous fires, it is only natural that the deterioration of the stands has frequently been very great. In such cases, therefore, the management has aimed primarily at the restoration of the forest conditions, preserving all useful growing trees of prospective utility, and utilising or destroying those of little or no value, with the obpect of securing reproduction on unproductive areas by natural means. During the last ten years this work has proceeded steadily with varying success, and several hundred thousand acres treated for partial regeneration, but some considerable time must yet elapse before these areas will be ready for systematic management under any special system, as the scarcity of trees of marketable size is very marked. In the meantime, the most urgent measures requiring attention are fire protection and thinning.



Inland Type.
Mixed Forest of *E. crebra* and *Callitris glauca.*

Fire protection is particularly difficult in the coastal areas, which belong to the more inflammable type of eucalypt forests in consequence of the higher rainfall inducing a vigorous growth of bladey grass and xerophytic undergrowth, which carry fierce fires in the dry season. Also as the rough grazing on the forests is suitable only for cattle, graziers desire to burn annually and unfortunately do so in spite of precautions taken. Protection is rendered more expensive also because the small amount of trade possible does not admit of the employment of sufficient labour on remunerative work to form an effective protective force. Light and early burning has been practised with some degree of success in minimising the fierceness of accidental or incendiary fires, but this can only be looked upon as the lesser of two evils and a first step towards complete protection in later years. Especially where reproduction occurs in groups amongst more advanced stands which may be lightly burned with safety, it is found that considerable damage is done to the more sensitive species in the groups—and the more sensitive are generally the more valuable. In view of the difficulty of ensuring adequate fire protection for the areas already regenerated, it has been deemed expedient to concentrate still more on the utilisation of low grade produce so as to deal with smaller areas per year, thus increasing the labour force available per thousand acres. At the same time, of course, an increase in revenue—even though it is small—is obtained from the labour employed.

Perhaps in no respect is effective utilisation more necessary to the proper treatment of the younger forests than in thinning. Eucalpts are essentially "room-demanding" trees, and if the requisite space is not provided in comparatively early youth, a marked falling off in vigour is soon observed, so much so that the dense patches established naturally in the last fifty years do not show growth at all comparable with that recorded from eucalypt plantations in other countries. In all such unthinned areas numerous instances of incipient stag-headedness can be seen, though no doubt the frequency of forest fires is also largely responsible for this condition.

Ordinarily the only forests in which small thinnings can be disposed of for any purpose are those in close proximity to the coal-fields, but otherwise there is no market whatever for anything below pole size. During the past twelve months arrangements have been made with the Railway Department for the Forestry Commission to supply pit props for the State coal-mine, and this has rendered possible the first attempts at commercial thinning of North Coast forests.

Hardwood forests in the neighbourhood of the Cessnock coal-fields, though generally much inferior both in possibility and actual stand to those of the northern half of the coast, provide much better opportunities for effective utilisation, and, consequently, measures taken to restore them show better financial results. Where converted produce can be disposed of at the stump, departmental conversion of pit timber is now being resorted to with the object of introducing system and establishing cutting cycles under a form of selection.

In those areas which have not been subjected to excessive exploitation, management aims of course at better utilisation and regeneration of cut-over areas as above, but is also directed towards preventing the competitive licensed cutting of earlier years and ensuring continuity of supply. Working sections are being allocated or reserved for the supply of definite mills, which are encouraged to look ahead and assist the Commission by cutting systematically and thoroughly in the interests of their future existence. At the same time, the hewing of sleepers, which was formerly considered to be of secondary importance, is being associated wherever possible with mill log cutting so as to ensure the utilisation of the over-mature portion of the stand.

The simple working plans laid down for hardwood areas are directed primarily towards systematic utilisation, sylviculture and protection, the present condition of the forests and forestry being such that regulation of the yield is either impracticable or of less immediate importance.

In those forests, which have been generally classed as the Cypress forests, the management has been concerned primarily with the limitation of the annual cut of Cypress in order to ensure continuity of supply of mill logs for a few years at least, but it cannot at this stage be foreseen how the future of some of these areas is likely to be regarded. Wherever existing growth eucalypts indicates the possibility of producing durable species suitable for poles and railway sleepers, attention is now being given to increasing the percentage of broad-leaved species at the expense of the Cypress, while, at the same time, experimental work with exotic conifers is being carried out on a small scale.

Afforestation with Conifers.

The fact that the value of the timber imports into the State—almost all coniferous—exceeds £2,000,000, and is greater than the value of the hardwood sawmill output at the mills is sufficient indication that the planting of softwoods should be in the forefront of any forestry programme. That it did not receive serious attention before 1918 is greatly to be regretted, because, at the present time, readily accessible Crown land of suitable quality and in areas of sufficient size to make economical working units is not easily located. Moreover, fifteen to thirty years ago plantations could have been established at half the cost required to-day, and would now have been well on the way to bearing the burden of the more extensive schemes necessary for the future.

The question of waste lands naturally comes to the front when afforestation is discussed, but, if by waste is understood sterile and badly-drained soils, it would be unwise to concentrate on such areas in New South Wales to-day. Its waste lands are comparatively extensive and might grow coniferous forests of a sort, but the quality could not be expected to be other than inferior. Many years must apparently pass, however, before the density of the State's population will be such as to allow the profitable marketing of large quantities of very low grade coniferous timber, and, in the meantime, attention is better directed towards the planting of land on which moderately good results are probable. Moreover, the expense of establishing the forests of the first rotation must be high on account of the preparatory work necessary to bring the land into suitable condition for the first planting, and poor forests cannot possibly yield a return commensurate therewith. Sandy heath lands are certainly better left for later generations to deal with.

The following summary of the afforestation position is extracted from the last report of the Forestry Commission:—

> As a first step it was decided to concentrate on a programme under which it was hoped to attain to a minimum planting of 5,000 acres annually, though it was recognised that as a first objective an annual area of 10,000 acres would not be too large, while if reliance has to be placed on species other than insignis the latter figure might well be doubled. Steady progress was made each year till, in 1924-25, the year's planting reached 2,350 acres, but thereafter a retrogression

set in, and, though it is hoped to effect a gradual improvement in future, there is no prospect whatever of the annual planting reaching 5,000 acres for several years to come.

The main difficulties preventing greater progress are those connected with lack of suitable land, choice of species and lack of trained staff. As regards land, the Commission is restricted in its choice of country to areas on the coast and in the highlands, for, owing to climatic conditions, anything but small scale experimental work is entirely out of the question in the central division.

Practically all the lower country in the coastal division capable of growing good natural forest is either selected or reserved for the growth of indigenous species, and the available Crown lands either contain very poor soil or suffer from bad drainage resulting from underlying rock or impervious clays. The two common exotic species—*P. insignis* and *pinaster*—are both unsuited to badly-drained soils, while they should preferably be planted under climatic conditions giving an assured winter rainfall, and consequently the original proposals for coastal plantations, while allowing early work with these species, provided for trials of new exotics till it could be decided which were the most suitable. Though this experimental work has not received the attention originally contemplated, sufficient information is now available to show that extensive work on the poor waste lands of the coast is not yet advisable.

The long-leaved pine of south-eastern United States, America, *P. palustris*, appears well adapted to poor soil and is the best species for general use—as far as its ability to grow is concerned—but the cost of the seed, poor germination, the difficulty of transplanting and the slow rate of growth in the first three years, all render establishment and early maintenance costs too high. *P. caribaea* and *taeda* from the same zone have given very good results on favourable soils, or where drainage has been undertaken, but in their case also the cost of seed and unsatisfactory germination prevent extended operations, even if the required soils were available.

For the southern coastal localities, *P. muricata* from California offers the best all-round prospects, except in the swamps and in deep sands, and this species will therefore be more generally used for the present. The seed is reasonably cheap and the behaviour in the nursery satisfactory. Other species under trial are *P. densiflora, luchuensis, insularis*, and *echinata*, but some years must elapse before any of these can be definitely accepted or rejected.

The middle highland belt, at an elevation of approximately 1,000 to 3,000 feet, and higher in the north, is a zone which offers less difficulty as regards species, for climatically it is well adapted to the fastest growing coniferous species of all, viz., *P. insignis.* Unfortunately, however, it is in this zone that extensive areas of suitable lands are most difficult to obtain, for, if settlement has not taken possession, either access difficulties are prohibitive or soil conditions are unattractive, as, for example, in the case of the large Hawkesbury sandstone belt. Most of the Commission's effective planting has been carried out in this intermediate zone wherever scattered areas of 2,000 acres or more could be obtained, and operations are capable of still further extension to a number of fresh areas, each of which is, however, comparatively small and isolated.

The only portion of the State in which it is possible to undertake afforestation on a reasonably large scale—as, say, the planting of 10,000 to 20,000 acres per year over a period of fifty years—is the snow belt in the southern highlands, which, however long delayed, is destined to be the future coniferous belt of New South Wales.

Since that report was written, attention has been turned to loan money available, through the Development and Migration Commission of the Commonwealth, and a tentative proposal has been submitted which will entail increasing the area to be planted annually over a rotation of from thirty to forty years by 2,500 acres, making a total annual acreage of nearly 5,000. This still leaves for future consideration the main body of country in the southern highlands, while, if it is found possible to establish plantations of *P. canariensis* at reasonable cost in the uncertain rainfall of the central districts, ample lands for future needs will be available.

Excluding, for the time being, consideration of *P. canariensis,* which produces by far the best structural timber of all exotic conifers yet introduced, the species chiefly favoured for the main planting areas are *P. insignis, laricio* and *ponderosa*, of which the first is the most highly productive, though it can be used with absolute safety only in first-class localities. In addition to its high yield, it has the advantage of cheap nursery work and of rapid growth in youth, rendering fewer cleanings necessary than in the case of other species. *P. ponderosa* and *laricio,* on the other hand, both require lining out under existing practice—though wrenching of seedlings in the beds is to be tried—and three years in the nursery; in addition, repeated cleanings in the young plantations are essential, and the increment cannot be expected to exceed 60 per cent. of that yielded by *insignis* in the first thirty years.

Apart from the usual difficulties associated with the change of species involved in the introduction of conifers, rabbit infestation is the outstanding problem in New South Wales, for the sparsely settled highland regions have become the stronghold of this pest, whose eradication is possible only at heavy expense. Wire-netting fences at over £100 a mile add considerably to the expenditure to be borne by plantations, while in the snow belt even this costly procedure is not by any means effective in winter when the snow lies as high as the netting.

Summarising the future prospects of afforestation—or rather conversion—one has to recognise that the only species which can be expected to yield satisfactory financial results from the first rotation is *Pinus insignis,* but this species is so exacting on soil requirements that in practically every locality in which it can be grown variations in the soil and subsoil conditions render necessary the introduction also of other and doubtful species, which reduce greatly the prospects of the area as a whole. In those southern or more elevated regions in which *P. ponderosa* and *laricio* can be grown, the initial expenditure associated with conversion and maintenance is too high in comparison with the rate of growth of these species to promise financial success from the first rotation. On the other hand, the ultimate benefit to this State resulting from the development of land of otherwise low grazing value and from the establishment of centres of rural industry is undoubted. After the first rotation, the coniferous forests and the sawmills dependent on them should provide more local employment than any other rural industry, except fruit-growing, yet established in the highland districts.

In general, it cannot be too strongly emphasised that a very exaggerated impression of afforestation possibilities in New South Wales—as in Australia as a whole—has been created by the very fine growth of *insignis* plantations which has been obtained on very small selected patches of first-class country, but which cannot in any sense be accepted as a criterion of the results to be obtained from large scale efforts on the Crown lands still available. What is required is a sober appreciation of the position and concentration on sound schemes undertaken with a very critical control of expenditure, not with a view to solving unemployment problems or "paying the National Debt," but simply in order to provide the necessary supplies of the future, and, at the same time, develop rural industries.

FORESTRY STATISTICS AS AT 31st DECEMBER, 1927.

	Acres
Area of the State	198,036,480
Area of State forests	5,314,000
Area of timber reserves	1,537,000
Area of State forests and timber reserves surveyed or assessed	4,411,000
Area of State forests for which working plans have been issued	1,115,000
Area of State forest under grazing tenure	2,127,000
Revenue for 1927	£246,000
Expenditure for 1927	£194,000

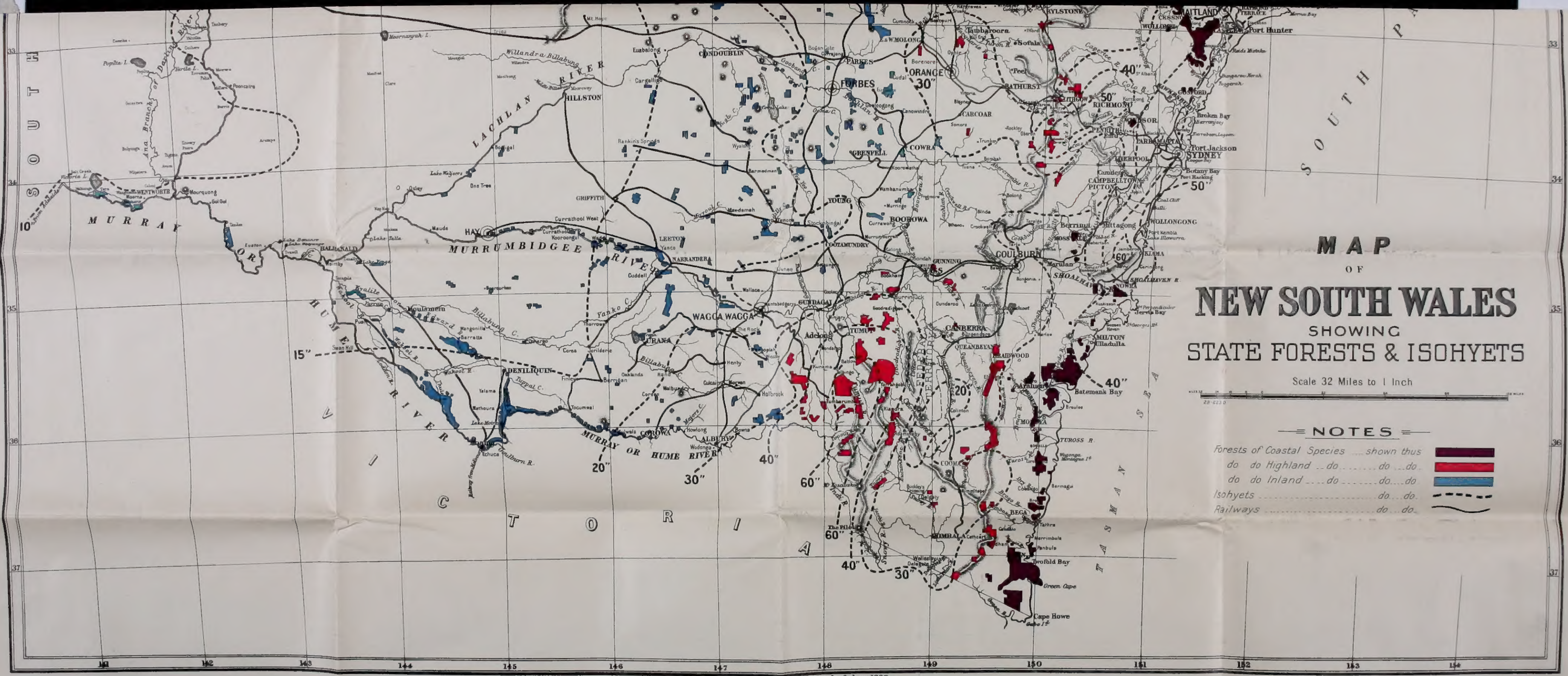
Output of Crown timber by classes of produce—	Cubic feet.
Mill logs	10,600,000
Hewn and split timber	2,100,000
Poles and piles	650,000
Mining timber	700,000
	14,050,000
Fuel	2,000,000

Output of Crown timber by species—	
Hardwood	9,650,000
Hoop	1,600,000
Cypress	2,400,000
Brushwoods	400,000
	14,050,000

Over-sea export of timber 1926-27, 1,542,000 cubic feet, valued at £507,000.

Over-sea import of timber 1926-27, 16,426,000 cubic feet, valued at £2,295,000.

Sydney: Alfred James Kent, Government Printer—1928.



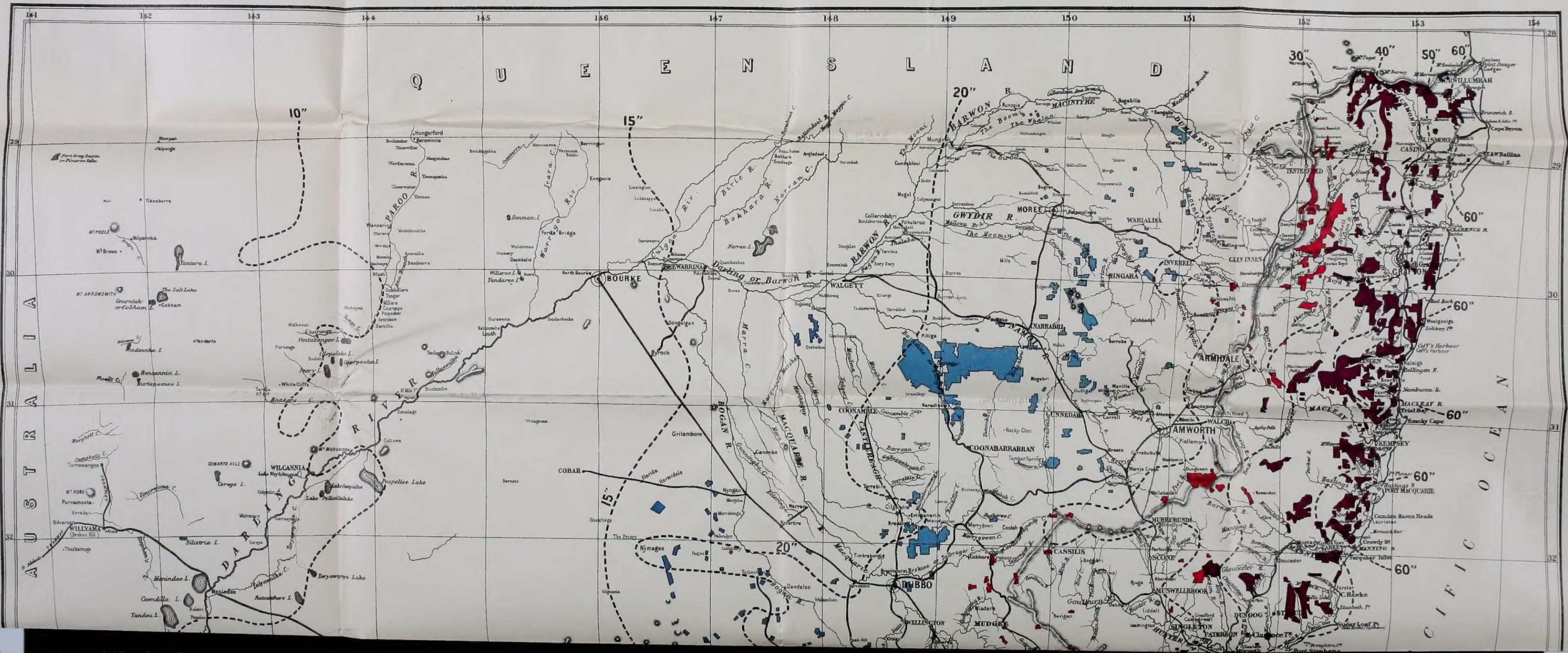
MAP
OF
NEW SOUTH WALES
SHOWING
STATE FORESTS & ISOHYETS

Scale 32 Miles to 1 Inch

NOTES

Forests of Coastal Species ....shown thus ▬
do do Highland ..do ....do ...do ▬
do do Inland ....do ....do....do ▬
Isohyets ....do....do - - -
Railways ....do....do ～

Lithographed and Printed at the Department of Lands, Sydney 1928.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Q U E E N S L A N D
A U S T R A L I A
PACIFIC OCEAN
10"
15"
20"
30"
40"
50"
60"
Hungerford
Tibooburra
Wanaaring
PAROO R.
Mt Poole
Mt Browne
Yantara L.
The Salt Lake
Cobham
Mt Arrowsmith
Bancannia L.
Mt Murchison
WILCANNIA
Poopelloe Lake
Mt Robe
WILLYAMA (Broken Hill)
Silverton
Menindee L.
Menindee
DARLING RIVER
Darling or Barwon R.
Talyawalka C.
Teryawynia Lake
Louth
BOURKE
BREWARRINA
Culgoa Riv.
Birrie R.
Bokhara R.
Narran C.
Narran L.
COBAR
Nymagee
Girilambone
BOGAN R.
MACQUARIE R.
Nyngan
Warren
Gulargambone
Coonamble
COONAMBLE
CASTLEREAGH R.
Gilgandra
Coonabarabran
COONABARRABRAN
Mungindi
BARWON R.
MACINTYRE
Boomi
GWYDIR R.
MOREE
WALGETT
Collarenebri
Pilliga
NARRABRI
NAMOI R.
Bingara
INVERELL
WARIALDA
Goondiwindi
DUMARESQ R.
TENTERFIELD
GLEN INNES
ARMIDALE
WALCHA
GUNNEDAH
TAMWORTH
MURRURUNDI
CASSILIS
DUBBO
WELLINGTON
MUDGEE
MERRIWA
SCONE
MUSWELLBROOK
SINGLETON
PATERSON
DUNGOG
Gloucester
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MANNING R.
Taree
PORT MACQUARIE
Hastings R.
KEMPSEY
MACLEAY R.
Smoky Cape
Trial Bay
Nambucca R.
Bellinger R.
Coff's Harbour
GRAFTON
CLARENCE R.
CASINO
LISMORE
Ballina
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